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ABSTRACT

The project of developing, demonstrating, and evaluating a systems approach for general college chemistry, general psychology, and developmental English was undertaken by Meramec Community College (Missouri). This report includes a chapter on the project philosophy, which hypothesizes that the maximization of instructional methods increases the potential of all students in meeting all of the objectives of a course. Chapters on each of the three instructional courses are given, as well as outlines for each course rationale, the course development process, and a course description. Appendixes include materials from workbooks on electrochemistry, the elementary psychology program, worksheets for the developmental English system, and an evaluation of the chemistry system. (RC)

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A REPORT TO THE

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A SYSTEMS APPROACH TO THE INSTRUCTIONAL PROCESS

Walter E. Hunter
Meramec Community College
Junior College District of
St. Louis & St. Louis County
Missouri

February 1970

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The project team is indebted to the Esso Education Foundation for a grant in the amount of $49,610, and to the Junior College District of St. Louis and St. Louis County for additional support amounting to at least $64,644. The team is also grateful for the opportunity to work within an environment of creativity at Meramec Community College in Kirkwood, Missouri.

THE PROJECT TEAM

Joseph F. Dunne, Assistant Professor of English, Meramec Community College
Mr. Dunne joined the Meramec staff in 1964. He is presently Chairman of the English Department. He is active in faculty association activities and in College governance. During the past two years Joe has presented major papers at regional and national meetings and has served as a subject matter consultant. During the 1969 summer he attended the Great Teachers Seminar in Portland, Maine.

Rudolph L. Heider, Professor of Chemistry, Meramec Community College
Dr. Heider joined the Meramec staff in 1964. He has served as Chairman of the Physical Sciences Department. He is active in faculty and professional activities. Prior to entering teaching Rudy worked as a research chemist and as an assistant research director at Monsanto Company. He serves on several American Chemical Society committees and regularly makes presentations at regional and national meetings.

Sandra Hofmeister, Project Secretary, Meramec Community College
Miss Hofmeister has worked with the project during its entire development and completion. She performed the essential tasks of the orderly preparation of materials and record keeping. Sandy also read project materials for their value as communication instruments. Her quiet charm and dedication favorably affected the progress of the project.

Walter E. Hunter, Associate Dean of Instruction, Meramec Community College
Mr. Hunter joined the Meramec staff in 1964. His primary interest and contribution to education is in the area of teaching and learning improvement. Prior to joining the Meramec staff Walter has taught chemistry, developed programed materials, designed electronic learning laboratories, worked in atomic energy commission research and served with the team responsible for the Chemical Bond Approach Project. He is presently serving as the district representative to the League for Innovation in the Community Colleges and as a consultant for the American Association of Junior Colleges Project with Developing Institutions.

L. Wendell Rivers, Assistant Professor of Psychology, Meramec Community College
Mr. Rivers joined the Meramec staff in 1965. He is presently Chairman of the Behavioral Science Department. Wendell has served both as a subject matter and learning consultant. He has presented papers at regional and national meetings. This year Wendell Rivers was nominated for the E. Harris Harbison Award for gifted teaching.

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CHAPTER I

A PROJECT REPORT

In March 1967 the Esso Education Foundation awarded a grant to the Junior College District of St. Louis and St. Louis County, Missouri, in the amount of $49,610 for support of a project entitled "A Systems Approach to the Instructional Process." This award was made to support the development and evaluation of instructional systems for General College Chemistry, General Psychology, and Developmental English at Meramec Community College in Kirkwood, Missouri. The project was directed by Walter E. Hunter, Associate Dean of Instruction at Meramec.

The project envisioned the establishment of a team of professionals charged with the responsibility of developing, demonstrating, and evaluating a systems approach for each of three college courses. The team members worked together in the broad sense of sharing ideas and techniques. And they worked separately, and with consultants, in the narrow sense of programing a systems approach for one college course.

A project of this nature could be initiated because instructional personnel at Meramec Community College were and are uniquely equipped to develop and demonstrate the systems approach to instruction. The following reasons were specified at the time of the proposal:

1. Meramec Community College is a new college with few traditions.

2. The Meramec Community College staff committees are currently involved in designing new campus facilities, and the results of all R and D projects will be used to guide these designs.

3. The Meramec Community College instructional staff has been selected on the basis of their creativity and dedication to teaching.

4. The Meramec Community College staff has already developed a number of significant instructional innovations.

5. The Meramec Community College personnel are continuously involved in research and development in the area of instructional improvement through an enlightened release time policy.

6. The college administrative staff solidly supports R and D projects designed to improve teaching and learning.

The proposed aims of the project were:

1. To develop a systems approach to instruction for three representative college courses.

2. To demonstrate the systems approach to instruction in three regular college courses.

3. To evaluate and publish the results of the development and demonstration of the systems approach to instruction.

This project was envisioned to irreversibly effect the current modes of college instruction by demonstrating that successful college teachers can develop and use a systems approach to instruction in a representive college course. The project director proposed:

1. To identify a team of three successful college teachers.

2. To work with this team both collectively and individually so as to expose team members to the spectrum of available new media -- both hardware and software.

3. To interact with team members in regular seminars for the purpose of discussing the current literature and sharing ideas.

4. To bring team members and consultants together so as to catalyze creative activity.

5. To charge individual team members with the responsibility of developing and demonstrating a systems approach to instruction for a college course in their area of major preparation.

6. To critically evaluate the development and demonstration of the systems approach, and to publish the results.

The project consisted of four distinct phases. Phase zero, during the fall 1967 semester, was identified as the self-learning period. This initial phase was especially important in that most college teachers have only limited exposure to educational psychology, current educational research, and the new technology.

The learning phase of the project consisted of a series of open seminars for interested faculty. Seminar participants enjoyed the opportunity to get acquainted with consultants, share ideas and initiate a search of the pertinent literature.

Phase one, during the spring and summer 1968 terms, represented the work phase of the project. Team members used this period to put together the components of the systems approach in their instructional area. They worked with subject matter experts, librarians, programing consultants, students, and each other as they engineered an individual systems approach for one college course. During the spring semester each team member was assigned to teach one section of the course he was programing so as to provide opportunity to try his new strategies and to keep his approach anchored to reality. The work phase required that team members be released from 80% of their class assignments so as to complete the program development. The initial steps in developing a systems approach for each team member were:

1. To firm an instructional strategy.
2. To establish self-goals for orderly programing of the approach.
3. To select methods designed to extract evaluative data for each step of the programing process.

Phase two, the demonstration phase, during the 1968-69 academic year, represented the high point of the project. During this phase, the associates applied a tailored systems approach to instruction to one course with real college students. Phase two offered the opportunity for visiting professionals to observe the systems approach and for the course engineer to utilize evaluation feedback to improve the on-going program.

Phase three, during the summer 1969 term, was envisioned as the evaluation phase of the project. This phase was perhaps the most important phase with respect to the project's impact on the educational community. The project director specified a critical analysis of all aspects of the developmental and demonstration phases, and the synthesis of a major publication reporting the project results.

The completion of the project and the publication of the results produced several measurable outcomes. Among these are:

1. An irreversible effect on the instructional personnel involved in planning and demonstrating the systems approach to instruction.

2. A narrowing of the gap between the available educational technology and its utilization by the nation's college teachers.

3. A significant increase in teaching effectiveness as measured by student achievement.

4. A significant increase in teaching efficiency as measured by teacher-student credit ratios and utilization of learning spaces.

Chapters IV, V, and VI of this report will contain a more detailed report of the specific instructional systems developed during the project.

As a result of the phase zero seminars three gifted and successful teachers were selected as project associates. Rudolph Heider, a chemist, was selected because of his enthusiasm for effective chemistry instruction. A Purdue University Ph.D., Dr. Heider has enjoyed a successful career as a research chemist, as a project director and as a college chemistry teacher. He had most recently completed a preliminary project related to the development of chemistry instructional systems. L.Wendell Rivers, a psychologist, was selected because of his thorough understanding of the learning process and his reputation as a good teacher. Mr. Rivers was well prepared academically having completed most of the course work for his doctorate in psychology. Joseph Dunne was selected because of his demonstrated ability to write and articulate his ideas. A bright young man, Mr. Dunne had moved to a position of natural leadership in the English department. He readily absorbed the concepts related to systems and had already developed some individualized instruction packages for the English learning laboratory.

Phases one, two, and three have proceeded on schedule with each project associate working on the development, demonstration, and evaluation of their instructional systems. Each associate: (1) Developed a different instructional strategy as based on a different set of objectives; (2) Established and performed in accordance with a set of self-goals; (3) Completed an evaluation report.

The Project Director served as a coordinator and advisor during the duration of the project. The time allocated to the project was spent primarily in relating the outcomes of the project to other professionals, both at Meramec and at other colleges. As a direct result of the Esso supported R and D efforts, the project director and associates have been in contact with hundreds of co-professionals nationally.

Through presentations and/or descriptive information at least the following organizations or colleges have had direct contact with the project:

Advisory Council on College Chemistry (AC_3)
Aerospace Education Foundation
American Association of Junior Colleges (AAJC)
AAJC Program with Developing Institutes
American Chemical Society (ACS)
American Institute of Physics
American Psychological Association

Behavioral Research Laboratory (Palo Alto, Calif.)
Behavioral Research Systems (Rockville, Maryland)
Burgess Publishing Company (Minnesota)
Center for Research in Learning & Teaching (Univ. of Michigan)
Center for the Study of Evaluation of Instructional Programs (UCLA, Calif.)
Central Midwestern Regional Education Laboratory, Inc. (St. Louis, Mo.)
Clearinghouse for Junior College Information (ERIC/UCLA)
Commission on College Physics (CCP)
Commission on Undergraduate Education in Biological Sciences (CUEBS)
Computer Sciences Project, Southern Regional Education Board
Conference on Improvement of Instruction (UCLA, Calif.)
Damon Engineering Systems (Needhan Hts, Mass.)
Division of Audio Visual Instruction - National Education Association (NEA)
Facilities Planning Project (San Diego State College)
General Electric Company (Schenectady, New York)
Glencoe Press (Beverly Hills, Calif.)
Harper & Row (New York)
Holt, Rinehart & Winston, Inc. (New York)
John Wiley & Sons, Inc. (New York)
League for Innovation in the Community College (Fifteen College Districts)
McGraw-Hill Book Company (New York)
Midwest Teachers of English in Two-Year Colleges
Missouri Junior College Physics Teachers Association
National Society for Programed Instruction (NSPI)
New England Chemistry Teachers
Raytheon Learning System
Regional Education Laboratory for the Carolinas & Virginia
School Research & Service Corporation (Fullerton, Calif.)
Southern Regional Education Board (Atlanta, Georgia)
Westinghouse Learning Corporation

As of the summer 1969 each of the developed systems have been perfected for continued local use. The chemistry instructional system has been used by more than 250 students enrolled in general college chemistry. Based on achievement of educational objectives, the failure rate in chemistry has dropped to less than 10% and some 65% of the students have achieved at the A or B level. The developmental English system has been used by more than 200 students. Since the developmental English system prepares students for success in English Composition the most convincing evidence for the support of the system will lie with students now enrolled in the regular English Composition courses. Preliminary evidence seems to indicate that students achieving the terminal objectives of the developmental English system do significantly better than the average college composition student. Based on achievement students enrolled in the psychology system, too, appear to learn not only more psychology but seem to enjoy it more!

All three systems:

1. Maximize self instruction activities;

2. Incorporate many different media for learning opportunities;

3. Provide for self evaluation of student achievement;

4. Utilize feedback for improvement of the system;

5. Utilize a mix of teaching talent - professor, teaching assistants and students;

6. Cost less when costs are analyzed on the basis of student achievement.

CHAPTER II

PROJECT PHILOSOPHY

LEARNING SHOULD BE THE RESULT OF TEACHING

Expectations

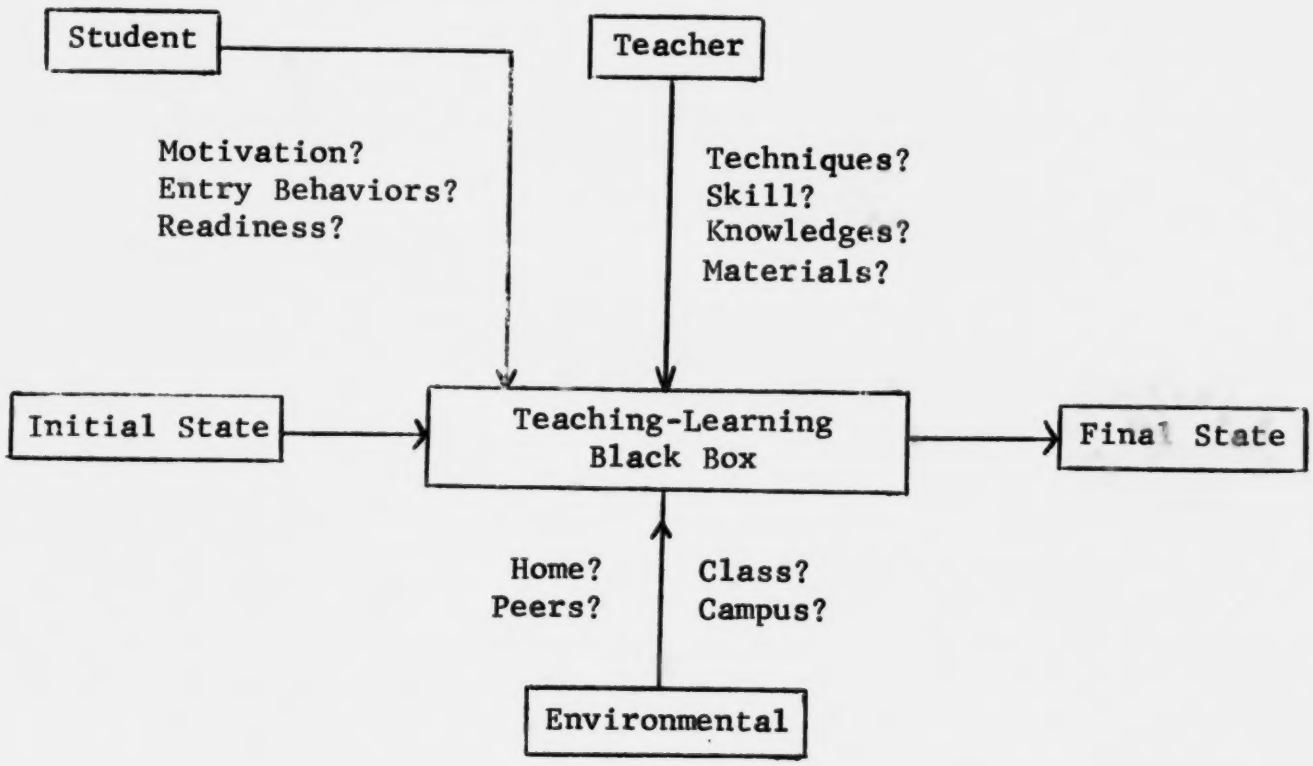
When teachers approach a new academic year and a new group of students, they are usually filled with expectations. Among these expectations is the fact that about one-third of any group of students will fail to achieve most of the course objectives (D or F grade), one-third will achieve some but not all of the course objectives (C grade), and one-third will achieve most of the course objectives (A or B grade). It appears that we have supported the normal curve expectation until it has become a self-fulfilling prophecy. Yet, when teachers are questioned with regard to student achievement of any one course objective they answer that most students can achieve most objectives under the proper conditions.

If the hypothesis that most students can achieve most objectives can be supported, then it follows that an educational practice which is based on failure is a most wasteful and destructive activity. This writer believes that the task before us to be quite clear -- we must discover strategies to assure that most students achieve most objectives. But before considering new strategies we should discuss, in a simple manner, teaching and learning.

Aptitude and Learning

Undoubtedly there is a difference between individuals with respect to aptitude for particular kinds of learning. Because aptitude tests enjoy a rather high correlation with student achievement, we may conclude that large differences exist between students with respect to potential for achievement. Yet even a cursory study of student achievement indicates that the so called slower students can achieve the same objectives as the top students if the mode and/or rate of learning is changed. Such data implies that variables other than aptitude for particular kinds of learning should be considered when predicting student achievement. These variables may include one or more of the following: (1)mode of learning, (2)readiness for learning, (3)time for learning and/or (4)motivation for learning.

Perhaps careful appraisal would reveal that aptitude test scores correlate with specific teaching techniques rather than a student's innate ability to achieve course objectives. When a group of students (individuals) enter a course, teachers assume: (1) that they all do their best; (2) that the teacher presents the important information; (3) that students are motivated and ready to learn; (4) that the students receive and assimulate course materials; and (5) that the evaluation techniques actually measure student achievement. This set of assumptions indicates that the relation between teaching and learning is hidden in a black box (Figure I).



Teaching-Learning Black Box
(Figure I)

In the usual course situation, what do teachers know about the initial state of the individual student? What are his entry skills, knowledge, understanding, motivation, readiness, past failure or success, etc.? What do teachers know about the teaching technique, its approach, the textbook, the level, its assignments, etc.? What do teachers know about the student's learning environment, his home, his peers, etc.? What do teachers know about evaluation, the number of tests, their type, their preparation, their scoring, the relation between test questions and course objectives, etc.? Teachers know very little about the answers to these questions because little attempt is made to answer them!

If we as teachers were to have the task of teaching Helen Keller, we would undoubtedly modify our teaching technique so as to compensate for her handicaps. Yet based on our existing highly verbal system, Miss Keller and thousands of other people would be and are doomed to failure. It seems possible that not all individuals are able to cope, with equal facility, with any one mode of instruction. If some possess poor verbal skills -- reading, writing, listening and speaking -- how are they able to learn in most classrooms?

Quality of Instruction

Many successful persons reflect upon their educational experience and remark how fortunate they were to have had some good teachers. They are probably saying that during their education four or five, of thirty or more teachers, had significant effects on their success. But what about persons who have not had the experience of interacting with even one good teacher -- are they any less able or simply less fortunate? If a teacher passes a student on to the next class with an enriched store of knowledge that student will probably do well in the next class -- if, on the other hand, the student is passed with an impoverished store of knowledge that student will probably do poorly in the next class! Educators have known for years that learning is accumulative; it is now time we recognize that lack of learning (ignorance) is also accumulative.

Techniques of Instruction

Educational standards are based on many extraneous qualities, which are seldom related to instructional techniques, quality teaching and/or student learning. Robert Dubin in a monograph entitled "The Teaching-Learning Paradox" makes the following statement:

> Underlying all belief-systems in the efficacy of one teaching method over another is an implicit model of how teaching and learning are linked. It is invariably assumed that when a teacher is teaching a student, the student is learning because of the teacher's intervention. This assumed linkage between teaching and learning is the morass in which much of the controversy about various teaching methods bogs down. [1]

The clear conclusion revealed in the monograph states that in an analysis of almost 100 studies of different college teaching methods the investigators "...found no shred of evidence to indicate any basis for preferring one method over another as measured by performance of students on course examinations."

---

[1] Durbin, Robert & Taveggia, Thomas, "The Teaching-Learning Paradox", CASEA/ERIC, Univ. of Oregon, Eugene, Oregon, pp.1-2.

Then what are the differences? They appear to lay outside of the traditional highly verbal, time locked, lectures, discussions, laboratories, textbooks and testing methods commonally used in colleges. Perhaps no differences are found because our educational strategies are usually group oriented, that is, we seem to seek techniques (teacher, materials, etc.) which are best for the group, rather than strategies which will assure individual learning. Students appear to be caught in a maze which requires that they guess what the teacher desires them to learn and then attempt to filter out that instruction which meets this criteria. Of course, this mode of operation is risky, but it's all part of the game called "pursue an education." Successful teachers are those teachers whose class activities allow most students to successfully guess the rules of the game.

Ability to receive instruction

When a teacher utilizes teaching techniques (materials, etc.) which are directed to a group of students, some students will inevitably be at a disadvantage. Group instruction: (1) is normally quite verbal -- non verbal students are at a disadvantage; (2) is normally aimed to the middle level student -- both lower and upper level students are at a disadvantage; (3) is normally based on the same textbook, outside reading, homework, experiments, etc. -- all students tend to be at a disadvantage in relation to efficient learning opportunities.

If instruction requires both teaching and receiving then techniques must be developed which assure a high fidelity link between teaching and receiving for all students.

Recommendations

In order to get at this high fidelity linkage the black box must be opened and the teaching-receiving mechanism analyzed. The following recommendations represent a first step toward improving the probability of a high fidelity linkage between teaching and receiving:

Expectation of success and perseverance. When learning is an enjoyable activity students tend to persevere, and when learning is frustrating students tend to give up. Thus, a major role of the teacher interested in assuring student achievement is the selection of the appropriate learning tasks and learning modes for individual students. A most rewarding by-product of selecting appropriate tasks and modes is the fact that students are able to learn much faster than they normally learn in other circumstances.

Behavioral Objectives should be available to the student. Student learners must know where they stand with respect to the expectations of the course. Much recent evidence suggests that the clear statement of objectives may be the most important step in the development of any learning system.

Small Group procedures should be available to students according to need. Such small groups might involve only two to five students working together, cooperatively, to achieve the objectives of the course. In the group process the more able students are strengthened as they help others, but most importantly, more students achieve the course objectives. Experience with small group procedures show that groups develop a feeling of mutual responsibility, pride and faithfulness which aids efficient learning.

Tutorial Assistance should be available to students with particular needs. The tutor should be someone other than the teacher because the tutor should employ alternate approaches to the learning process. This may be the opportunity to employ differential teaching assignments by utilizing a mix of successful students, teaching assistants, instructors, and experienced professors.

Different textbooks, programs, and problems should be available to student learners. Different students will undoubtedly find different learning materials more appropriate to their interests and abilities. When students have the opportunity to select learning materials which are appropriate for their needs, learning is increased due to interest, motivation and perseverance.

Alternate audio-visual pathways to learning should be available to individual learners. If learning is the change from the initial state of the learner to the final state of the learner it is reasonable to assume that many pathways should be available to the learner. These pathways range from vicarious experiences, like reading, through simulated experiences, like laboratory, to concrete experiences, like real life.

Don Stewart[2], in a recent communication, stresses that achievement of the behavioral objectives should be carried out as efficiently as possible. Figure II illustrates this concept.

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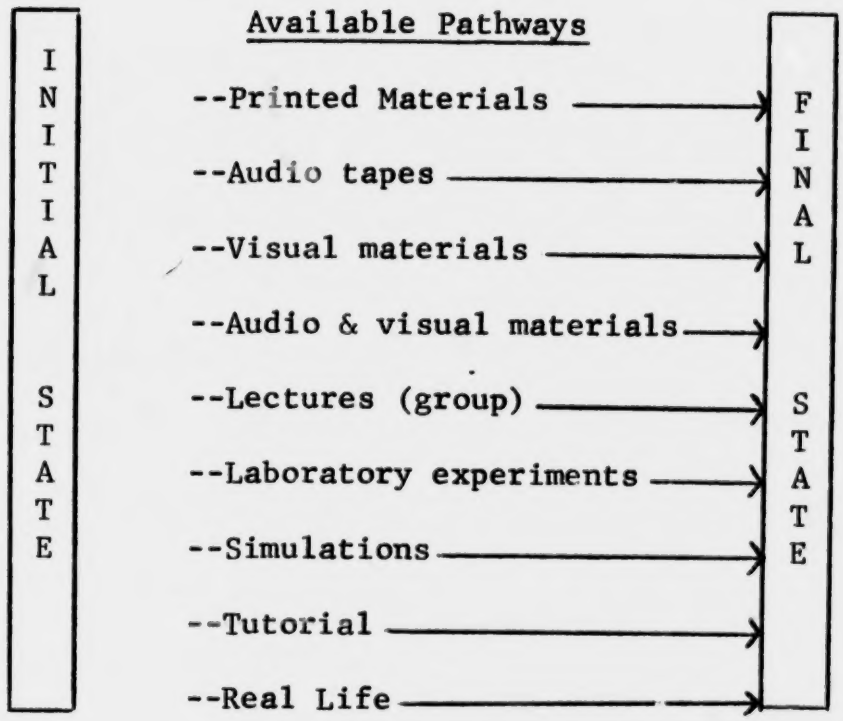
[2]"The Learning Systems Approach to Instruction and the Changing Role of the Educator", SLATE Services, Westminster, Calif.



(Figure II)
Efficient Learning is based on
providing a number of learning
pathways to assure student achievement

As illustrated, printed materials enjoy an advantage of being relatively inexpensive and are nearly always available. Tutorials are, on the other hand, quite expensive and difficult to arrange. Real life is, of course, expensive and sometimes frustrating -- but also very meaningful. The obvious significance of this breakdown is that many pathways are available and that that pathway which is best is a function of the objective and the individual learner.

CHAPTER III

THE PROJECT

A SYSTEMS APPROACH TO TEACHING & LEARNING

Motivation

Education is confronted with many problems: both knowledge and student population are expanding geometrically, good teachers are in short supply, physical facilities are inadequate and improperly located, costs are rising, income is limited. One of the most perplexing problems, however, is related to the intelligent utilization of the new technology -- the same technology which may solve many of the problems listed above. Thus, a widening gap appears to exist between the current educational state and the new technology. It is safe to predict that the problems of education will continue to produce (a) busier teachers, (b) higher costs, (c) lower efficiency, (d) greater confusion, (e) more cheated students, and (f) a more dissatisfied community. Unless this trend is discontinued and reversed the systems of education may eventually collapse from frustration and an inability to solve internal problems.

In order to prevent chaos, efforts must be made to reverse the present trends and to narrow the gap between problems and their solutions. Perhaps entirely new solutions will be required to solve old problems. One of the new solutions is known as a Systems Approach to Teaching and Learning.

A Systems Approach

The words "systems approach" simply mean an orderly approach for solving problems -- a structured process based on a study of all the variables related to a problem. Since the teaching-learning operation is a problem, it should lend itself to an orderly solution process.

The development of a systems approach to teaching and learning consists of:

1. Defining educational objectives.
2. Developing evaluation to measure the learner's achievement.

3. Providing learning pathways for the learner.
4. Using feedback to reinforce learning of the objectives.
5. Using feedback to continuously improve the system.

As indicated above a systems approach to learning and teaching is based on the careful development of a set of educational objectives. These objectives must be clearly stated in behavioral (i.e., operational) terms. In a pragmatic way the following guidelines were helpful in writing educational objectives:

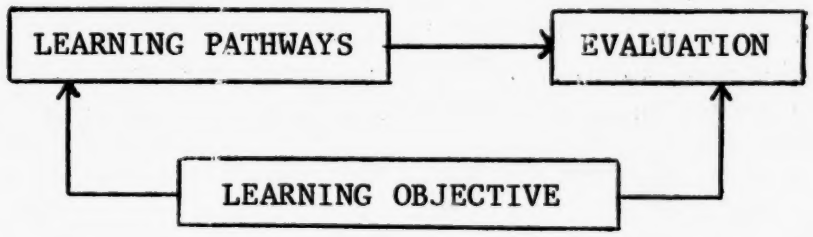
1. Write each learning objective in a concise manner placing emphasis on clarity.

2. Write each learning objective so that it is realistic with regard to level.

3. Write each learning objective so that it defines what the student is able to do as well as the accuracy and conditions of his performance.

4. Write each learning objective so that its achievement can be evaluated.

Once such objectives are developed the remaining activities are primarily evolutionary and can best be developed by teachers experienced in developing learning strategies and evaluative materials. Each learning objective, for example, leads to an evaluative item (a measurement which validates achievement!). Further, each objective serves as a base for the development of appropriate learning pathways. (Figure III)



(Figure III)

Learning pathways usually consist of a variety of prescribed activities which lead the student to the achievement of the stated objective. Thus, lectures, demonstrations, problems, experiments, films, programed materials, readings and so on provide effective learning pathways.

When students enter a new course, teachers usually assume that all the students approximate the required entry behaviors. This situation is, of course, not valid because students seldom arrive in homogeneous groups ready

to be taught. The teacher's intuition may suggest that all students are not equally prepared to learn; however, his vision of his job as a teacher motivates him to move on and do the best he can do. Thus, his best usually assures that most, but not all, students will achieve most, but not all, of the goals of the course. To overcome this difficulty the systems concept requires that a pre-entry test be prepared, validated, and administered prior to course entry. The pre-entry test measures achievement of all behaviors assumed to be required for course entry as well as those behaviors stated as educational objectives. The results of a pre-entry test may lead to one of three conclusions for each student. These are:

1. The student possesses the entry behaviors.
2. The student does not possess the entry behaviors.
3. The student possess the entry behaviors plus some of the behaviors included in the course.

The educational objectives, as a whole, further describe the terminal objectives for the course. Thus when the terminal objectives have been achieved the learner can be congratulated and his achievement properly recorded. In the case of sequential courses the terminal behaviors of one course serve as the required entry behaviors of the next course.

A Teaching-Learning Model

As a basis for developing a new teaching-learning model a new set of assumptions about human learning is proposed. Carl R. Rogers[3] makes the following assumptions about learners:

1. Human beings have a natural potentiality for learning.

2. Significant learning takes place when the subject matter is perceived by the student as having relevance for his own purposes.

3. Much significant learning is acquired through doing.

4. Learning is facilitated when the student participates responsibly in the learning process.

5. Self-initiated learning, involving the whole person of learner -- feelings as well as intellect -- is the most pervasive and lasting.

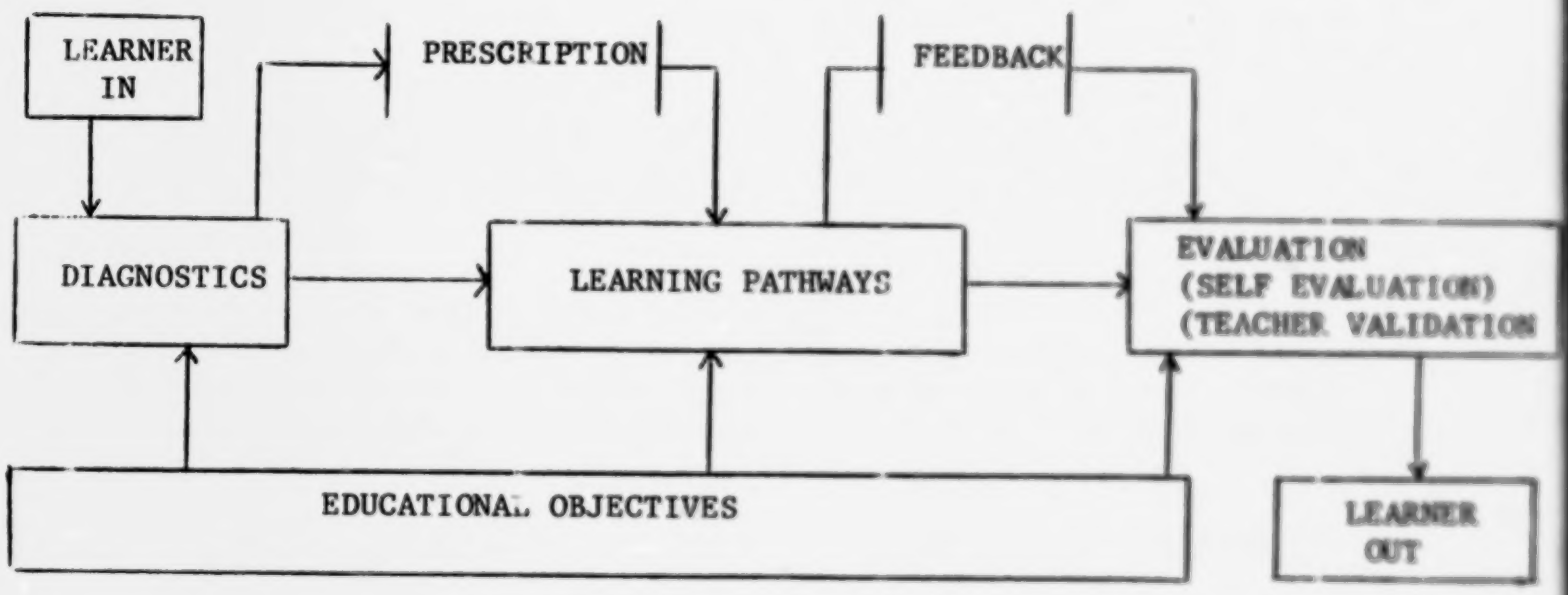
6. Creativity in learning is best facilitated when self-criticism and self-evaluation are primary, and evaluation by others is of secondary importance.

---

[3]Rogers, Carl R., "The Facilitation of Significant Learning", from Instruction-Some Contemporary Viewpoints, ed. Laurence Siegel, Chandler Publishing Co., 1967, p. 42.

7. The most socially useful learning in the modern world is the learning of the process of learning, a continuing openness to experience, an incorporation into oneself of the process of change.

When these assumptions are coupled with the concepts of a systems approach a different paradigm results. (Figure IV)



(Figure IV)

This paradigm possesses the qualities ascribed to in this report. When the initial state of the learner is adequately described it becomes possible to select learning tasks and pathways which maximize the learner's natural potential for learning. Thus, the teacher becomes a sympathetic diagnostician and counselor as he helps the learner solve his learning problems. Cooperatively the learner and the teacher decide on the learning task and pathway -- the learner then initiates the appropriate activity. Evaluation is used as feedback for the learner's self-appraisal, for the validation of student achievement and for the improvement of available learning strategies.

It seems clear that the systems model enjoys some distinct advantages from the student point of view. Among these are:

1. Students are able to proceed at an individual rate.
2. Students are able to select from a variety of self learning activities.
3. Students may maximize contact with the teacher.
4. Student self evaluation is primary.
5. Students learn how to learn.

At the same time some disadvantages might be stated:

1. Teacher contact time is increased.
2. Reliance or student self-discipline is increased.
3. System maintenance is demanding.

At first glance a system of this sort appears to be quite expensive; however, one should recall that many students will require less teacher time, less intimate contact with the college, and consequently lower expenses. Students requiring more teacher time, and more intimate contact with the the college, and thus greater expense will be more than compensated for by the fact that they are now able to successfully complete the course objectives. When cost analysis are made on student-credit output and not on student-credit input significant cost reductions may be predicted.

CHAPTER IV

A SYSTEM FOR THE INSTRUCTION OF CHEMISTRY

Introduction - Historical

In March 1965 a request was initiated by Rudolph L. Heider to obtain release time from the Junior College District to start investigating the feasibility of an audio-tutorial chemistry course. Biology A-T had progressed to the extent that carrels and equipment were available to permit a pilot study in chemistry.

During the June-August period in 1965 rough draft copies of seven different topics in chemistry were prepared. In the fall semester, a number of students volunteered to listen to the tapes and provide feedback concerning their quality. No writing was done during the summer of 1966 due to Dr. Heider's participation in a National Science Foundation program at Oregon State University.

As a result of previous work, Dean Walter Hunter and Dr. Rudolph Heider were successful in obtaining a small grant from HEW to continue our exploratory work.

During the academic year, September 1966 to June 1967, preliminary raw materials were developed for one semester's work, ranging from one-half to two weeks work per unit per student. As a result of this work (which was primarily "lecture" material on tape) we envisioned moving towards a loosely programed, multi-media approach, which differed, educationally, considerably from the initial work.

Extended time was granted by the Junior College District to work on the further development of an audio-tutorial course in General Chemistry during the summer of 1967. At this time the previously written rough draft manuscripts were extensively revised and edited and workbooks were developed for several of the units based on a multi-media, programed educational philosophy. Four master tapes were recorded for further testing with students.

With the installation of the required tape decks and switching gear and the employment of a teaching assistant, one pilot section (about 15 students) in A-T was initiated. A conventional lecture-laboratory approach

was used for the remaining three sections of General Chemistry 72.113 in September 1967. This was the point of entry of the Esso Project.

Educational Philosophy & Development

At the beginning the course system developer was mainly interested in developing a teaching mode that would individualize chemistry instruction. Chemistry instructors have too long persisted in the traditional lecture-laboratory approach despite lower and lower "yields" per year of chemistry majors and an agreed understanding that students learn at different rates and by different means.

Initially, "information output" was something done by the professor that might easily be automated. Thus, why not put the lecture on tape? Now the student could listen at his convenience and repeat it as often as desired. A lecture -- especially an excellent presentation -- does have the "live" quality obviously missing on a tape. Further, a lengthy listening period of information presented on tape can be deadly boring. Most students have a low concentration span and soon tend to daydream. Because of this observation, it was decided to make information "bits" no longer than 3 minutes in length. If the student became inattentive, he could easily repeat the bit before he became thoroughly lost.

The next step -- a logical outgrowth -- was to couple the philosophy of a programed text to the audio-tutorial presentation. That is, present material in small bits and then have the student give an overt response.

The nature of the response, whether doing a written exercise, performing an experiment, viewing films or other visual matter, or reading supplementary printed matter was organized into what evolved into a Workbook. Next the Workbook became keyed to the audio received via tape, and the student's response could be programed in the most effective learning pattern that the instructor could conceive. Further, this gave the student immediate feedback to assess for himself whether learning actually took place. If he had difficulty, a tutor was always readily available to assist him personally by suggesting other learning paths.

The next step in the development of a system concerned developing educational (behavioral) objectives for each of the Units. These were then incorporated into the Workbook and gave the student precisely what was expected of him by the time he had completed the Unit. Whereas prior to writing educational objectives it was necessary to be rather insistent that the student use the magnetic tape, it then became only one string of the total learning instrument.

The taped audio is regarded as only one of a number of means available for the student to learn the material. Since it is difficult to pinpoint

the cognitive factors best suited to each individual, the system provides the student with a multi-media approach and aids him in defining the path by which he learns most readily. The student, recognizing by means of the educational objectives what he must be able to do prior to taking the exam for a specific unit, is given the complete freedom to learn the material in any way he wishes. Now, of course, the audio tape becomes one of several tools available to the student. Obviously, if a student is an excellent reader and learns best via the printed word it is of little help to him to insist that he listen to the taped material. Despite this flexibility, the use of the tape is widespread among the students. Perhaps because it offers a fair degree of privacy and comfortable working quarters -- as well as a convenient method of learning the subject.

The next important step in the development of the system involves the use of a random access audio retrieval system. Each bit of information, 30 seconds to three minutes in duration, is coded and is available to the student in the laboratory, in the library and at several other sites on campus. This offers the student even more degrees of freedom: more learning, stations at different locations, during more time.

One can view the system that has evolved as a course in learning how to learn with Chemistry as an example. The student, recognizing that if he has clear-cut objectives, will be able to learn by himself, free from a "classroom" and free to use any materials that are pertinent. He will have learned the various sources that are open to him, i.e., the laboratory, the tutor, the library, visual aids and demonstrations of all types. It is believed that successful learning along these lines will develop the student's self-confidence and teach learning habits that will remain with him throughout his lifetime.

Future Work

As already indicated, the next immediate step will be to use the audio retrieval system and to go through the recently developed second semester program for the first time.

Further in time, the system may be programed to use computer mediated instruction as a means for determining the effectiveness of various portions of the program. Extensive work is required, particularly in devising effective software. Student responses would be stored in the memory bank of a computer and could be analyzed by the instructor on call. Without the aid of a computer, student response pathway and effectiveness of learning individual bits is not feasible. Dean Walter Hunter has been conducting meetings with General Electric and others in an attempt to determine costs and equipment involved.

In the distant future, instruction at home by means of the telephone may be envisioned. At such a time it would be necessary for the student to use the laboratory only for experimental purposes.

At that point in time after we have stabilized the system, efforts should be made to evaluate[4] this mode of instruction with other competitive modes. We have not been too eager to start evaluation too soon, particularly during the developmental phases of the system. Too early evaluation usually results in overly-optimistic or overly-pessimistic viewpoints. We are, however, reaching a less dramatic change in the developmental aspects and will soon attempt thorough evaluation using well-conceived procedures, if, indeed, it is feasible to make valid comparisons.

Accomplishments

All the software which had previously been developed for the first semester course under JCD and HEW sponsorship was extensively revised and edited so that the college press was able to publish preliminary copies of Workbooks for Units I through XII. These materials were copyrighted in 1968 by Dr. R.L. Heider.

Most of the second semester materials were developed under the Esso Grant and publication by the college press occurred during August-September 1969.

Workbooks, scripts and magnetic tapes for the following units are now complete:

1. Matter, Measurement & Energy
2. Charge Flow and Subatomic Particles
3. Atomic Structure
4. The Periodic Law
5. Chemical Bonding
6. Nomenclature and Equations
7. Calculations and Atomic Masses
8. Properties of Gases
9. The Solid State
10. The Liquid State
11. Solutions
12. Reaction Rates & Chemical Equilibria
13. Chemical Thermodynamics
14. Electrochemistry
15. Acids, Bases & Ionic Equilibria
16. The Metals

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[4] Evaluation by Glenn R. Baas, a Ford Foundation teaching intern at Meramec, appears as Appendix A of this report.

17. Noble Gases and the Halogens
18. Boron, Carbon and Silicon
19. Nitrogen and Group V-A Elements
20. Oxygen and Group VI-A Elements
21. Nuclear Chemistry
22. Stereochemistry and Organic Chemistry

Meramec Community College Program

The chemistry system, of course, draws heavily from the work at Purdue and from research in learning, training and education performed by various U.S. Bureaus, colleges and institutes. However, the system design is more concerned with programing, educational objectives and immediate response and reinforcement than the previous audio system reported. Essentially, the system employs the educational technique of a programed text, utilizing all types of effective media; thus, for the first time, bringing a fusion of activities -- laboratory, homework, lecture and evaluation -- that are normally isolated and disconnected.

Traditionally, the students attend a one-hour lecture three times per week, have one hour of discussion in a classroom situation and once a week have a laboratory work session for several hours. Along with each of these formal sessions are homework assignments. Feedback to the instructor on an individual student's progress occurs only two to three weeks later, usually too late to rectify major problems that some students have encountered, since his problems frequently cannot be readily identified at that time.

B.F. Skinner, et al, have shown the importance of immediate response to the effectiveness of learning. Thus, it follows that the learning elements in the traditional approach are too widely separated in time for efficient learning. This leads one to view all phases of the study of chemistry as components of the whole system. When information transfer is required, this is given via magnetic tape, printed matter, or visual aids. In order to demonstrate how a given principle is derived, it is helpful to do laboratory work at that time; thus, laboratory work and information transfer are interspersed. In essence, it is possible to use a learning situation, which may be at any time what previously was a separate lecture, laboratory, discussion or homework period, to effect a fusion of all these functions with feedback information to inform the student of his step-wise progress. This has another important advantage, i.e., after the curiosity of the student has been aroused and he is motivated, he may immediately do laboratory work, perform a demonstration, or work a problem to experience what actually happens. Contrast this to having a lecture at 9 a.m. Monday and a Friday afternoon laboratory period covering the same subject wherein he might satisy his curiosity -- if any still remains!

The audio-tutorial teaching procedure as introduced by Dr. S.Postlethwait for teaching Plant Science has four main parts: These are the class meeting,

the independent study, the seminar period and the quiz period. In the General Chemistry system the class meeting on Monday morning is a one-hour per week meeting of all the students in a large lecture hall, which seats 150 students. The instructor in charge of the course sets the stage for the week's work. This includes guest speakers, motion pictures, etc., with the primary purpose of integrating and orienting the subject matter so the student may appreciate its overall significance. The major purpose of this meeting is to motivate the student by convincing him that the topic is one he should take the time and energy to learn and not to "lecture". The topic is discussed so that it relates to the student's desire to know about himself and his environment.

Independent study is done in laboratory -- which is open from 8 a.m. to 5 p.m. each work day. A qualified instructor is on hand at all times to guide and give personal assistance to all students. The student has access to the tape recording for the unit, has his laboratory equipment at hand, and brings necessary workbooks, graphs, and other supplies for both laboratory or desk work. The student interacts with the audio program on magnetic tape. The audio instruction is designed to lead the student carefully through a programed series of learning experiences. Typically the student works problems, collects and organizes data, performs experiments, makes observations, views films, reads reference materials, discusses the chemistry, and works through programed materials as guided and suggested by the taped audio program.

The student is charged with the responsibility of completing the week's work by Friday noon. This gives him more than four and one-half days in the week in which he can pace himself and choose the time he wishes to do his work. Obviously he proceeds at his own rate and so proceeds through the unit for that week's assignment.

During the week, after the student has had an opportunity to interact with the program, groups of six to eight students are scheduled into 30-minute seminar periods where questions may be raised by the instructor or the students, and a general discussion takes place. This seminar period serves to acquaint the instructor with each student on a first name basis and is particularly effective in exploring a wide range of subjects, including career and counseling questions of interest to the student.

An attempt has been made to eliminate the seminar period in an effort to conserve time, but experience has shown that this is a vital part of the system and the seminar has now re-instituted as part of the system. Attendance is mandatory at the present time in that those students who are well motivated and doing well invariably attended the seminar, but those who needed it most, tended to drift off after several weeks.

The seminar period differs from some audio-tutorial programs in that no attempt is made to extract grades based on oral quizzing. It is felt that this tends to inhibit free-and-easy discussion which might lessen interest in the subject and create a hostile atmosphere.

Finally, at the end of the week, the entire class assembles in a large lecture hall for a short written quiz lasting from 20-30 minutes.

To reinforce learning at the quiz session, NCR two-part carbonless paper is used. When the student receives the quiz, each page has a duplicate yellow NCR paper page. As he writes on the top white sheet, a carbon copy is produced. After he has completed the quiz, he tears off the yellow carbon, turns the white copy in to the instructor and leaves the room. In another lecture room, or in an adjoining laboratory, the correct responses are posted, an instructor is on hand to answer questions, and the student grades his quiz. After checking his answers, asking any questions and recording his grade on the yellow copy, he leaves the yellow copy with the instructor and proceeds on his daily schedule.

The instructor has both the white and the yellow copies and can quickly scan each quiz to ensure that the grading was correctly done. This procedure offers immediate reinforcement for the student thereby enhancing learning and, at the same time, eliminates considerable grading by the instructor.

The student is required to use a textbook, which currently is General College Chemistry, 3rd Edition, Keenan and Wood (Harper and Row), a laboratory notebook which consists only of cross-section paper and a workbook for each unit, by Dr. R.L. Heider. A paperback on problem solving in General Chemistry is also strongly recommended.

Each student also has a complete kit of laboratory equipment for his use in doing demonstrations and experiments.

In the laboratory the student may use film strips and film loops for the unit being studied. In addition, an Autotutor Mark II (Welsh Scientific Co.) with their course in Basic Chemistry is used on a trial basis.

Textbooks, handbooks, and programed materials are available in bookcases in the laboratory for use either at the student's position or for check-out on an overnight loan basis.

During the year, most of the films prepared by the Chem Study group are used, usually at the end of the Monday morning orientation period. Students find these films interesting and informative. A set of key questions pertaining to the film which the student answers after viewing the film will be prepared at an early date.

The workbook for each unit is purchased at the bookstore and includes detailed educational specifications which form the basis for the evaluation quizzes at the end of the week, drawings, experiments, demonstrations, problems to solve, all keyed to the tape. A selected bibliography is also part of the workbook which lists texts, programed materials and films for that specific unit.

As the student proceeds through the taped program, he uses his workbook for notes, problem solving and similar activities. After the completion of the unit, the student hands in the workbook for grading. The grade is recorded and becomes a part of the semester grade.

Copies of Workbook[5], Script, and Tape

Copies of the workbooks, scripts, and tapes may be purchased by September 1970 by writing to Andrew E. Ford, Director-Educational Services, John Wiley & Sons, New York, New York 10016.

Acknowledgement

The assistance of the Esso Education Foundation was invaluable in aiding the development of an audio-tutorial system. We sincerely hope that this project has assisted in the development of individual instruction of interest and quality to the student.

[5] Representatives portions of Unit XIV - Electrochemistry - appear as Appendix B of this report.

CHAPTER V

THE DEVELOPMENT OF AN INSTRUCTIONAL SYSTEM IN PSYCHOLOGY

Introduction

Purpose: The purpose of this report is to describe a sequence of efforts to design and test a model program for teaching and learning elementary psychology, which is based upon a systems approach to education. The main emphasis of this report will be upon a statement of the rationale underlying the system, a description of the system, a summary of the results of a limited, statistical analysis of student performance, and a statement of projections for further development of the program model.

Rationale: The basic model underlying the program has evolved from systems engineering. The model is composed of a number of components; each of which is designed to provide the student with learning experiences which will help him to progress to the next component of the system. Characteristic of a systems approach, the present program is based upon the following aspects:

1. A set of specifically stated educational objectives.

2. A set of definite instructional objectives.

3. Provisions for multiple pathways through the system.

4. Provisions for the utilization of student responses and teacher evaluation to improve the system.

5. Adaptability to the changing design and functionality of newer media as it becomes available.

6. Provisions for the evaluation of achievement and the immediate feedback of performance status.

The development of this program consisted of the execution of eight basic steps. First, a determination of the need for a new approach for teaching and learning in elementary psychology was made. Second, a search for and the development of measurable learning objectives was undertaken; third, an analysis of the possible constraints inherent in the application of the systems design to the teaching of elementary psychology was undertaken. Fourth, possible alternative solutions to the problem were considered. Fifth, a selection of the best model for our pruposes was made. Sixth, a pilot program involving a select group of students was initiated to test the functionality of certain aspects of the proposed program model. Seventh, an evaluation of the results of our pilot program was performed. Eighth, adjustments and modifications were made in the model configuration based upon our previous evaluation of its functionality.

Program Description

Problem: In the past, the first course in psychology has involved the student in a jumble of unrelated, theoretical concepts which bear little relationship to the empirical experience of the individual. Past experiences seem to indicate that most students are interested in the application of psychological fact and method to their milieu; the student world of jobs, marriage, politics, war, sports. But frequently this interest is received with conscious estrangement by instructors whose hope it is to entice students into a more intensive and direct contact with the world of psychological theory and methodology. The basic problem then is how to bring about a closer rapprochement between student and course within the introductory course in Psychology.

It is our opinion that if the general course of psychology is to be more meaningful to the majority of community college students, it is more likely to be in the area of doing rather than knowing. The emphasis should be upon giving the student "hands-on" experience with equipment which allows the demonstration of basic psychological phenomenon. In trying to revise a general course to conform to the preferences of students without recanting completely a scientific orientation, one should introduce all of the major areas of Elementary Psychology and suggest a circular dependency: That is, the student depends upon the instructor for guidance into the appropriate topic areas; the instructor, in turn, depends upon the available literature, media and equipment to be relevant to a set of selected topics (objectives); and student ability, available literature, media and equipment derives its value from the use to which it is put by the student. The important aspect of the instructional approach to be described is that the student will actively and individually derive many of the facts of behavior through his participation within a highly structured system.

Educational Objectives: In the management of the first course in psychology at Meramec, efforts are directed toward four overall goals.

1. The student will be able to describe and demonstrate the elementary forms of human and animal behavior.

2. The student will be able to analyze elementary forms of behavior.

3. The student will be able to control elementary forms of behavior.

4. The student will be able to make predictions concerning elementary forms of behavior.

Instructional Objectives: Each unit of the instructional program is characterized by the statement of a number of tasks which the student should be able to carry out as a result of his involvement with that particular unit. These tasks have been termed "Instructional Objectives." As a result of the achievement of the total set of instructional objectives of the course, a student will be able to: (1) Demonstrate a criterion level of proficiency in the utilization of several kinds of basic elementary psychological apparatus; (2) Demonstrate a criterion level of proficiency in the application of basic methodological principles in the analysis of elementary forms of behavior; (3) Demonstrate an understanding of the principles which underlie behavioral analysis and control.

Multiple Learning Pathways: The program provides a number of ways in which the learner may achieve the instructional objectives. First, during the semester, 30-31 lectures are delivered by the instructor. The content of these lectures is designed to introduce the basic outlines of a topic area and to elicit questions concerning more intense aspects of the topic. Second, a special section of the library is organized around texts, papers and programed material, the content of which is highly correlated with the content of the lecture topic. Third, audio/visual material is available for student usage. A special audio/visual tutorial program has been organized around three hundred color slides, audio taped materials, locally prepared overhead projections, and commercially obtained recordings. These media may be utilized throughout the year in conjunction with the psychology laboratory exercises. Fourth, a limited facilities psychology laboratory has been established on campus. The main function of this laboratory is to allow students to demonstrate and analyze elesentary forms of behavior. Students experience direct interactions with the equipment; from which is generated observable manifestations of the phenomenon being discussed in the several learning components of the system. In addition, they have opportunities to observe many of their own psychological processes in these interactions.

Course Content: The content upon which the program is based is divided into two parts. Part I involves nine topics; the Origins of Modern Psychology; Scientific Methods; Descriptive and Sampling Statistics; The Biological Foundations of Behavior; Perception; Motivation; Learning and Cognitive Processes;

and Memory. Part II deals with Social Behavior; Personality; Frustration and Conflict; Behavior Pathology; Varieties of Psychotherapy; Psychological Testing; and An Introduction to Developmental Psychology.

System Configuration

The program is conducted according to a systematic flow of activities. The system is composed of four components: A lecture-discussion (LD) unit; a library (LB) unit; a laboratory (LT) unit and an evaluative (ET) unit.

Lecture-Discussion and Library: These two components comprise the input units of the system. The LD unit is designed to accommodate 150-300 students. The primary activity of the student in this unit is to receive basic information concerning a topic, in lecture form. The student has an opportunity to clarify topic sessions within the classroom situation. The LB unit is designed to provide an extension of the information received in the preceding unit. Here, the student is led into activities which amplify the prior information he has received. Special aids are available to assist the student in this task.

Laboratory and Evaluative: These components comprise the output units of the system. The main activity of the student in the LT unit is experimentation and audio/visual tutorial involvement. The ET unit is made up of selected test items which are designed to assess the degree to which the student has achieved performance criterion from his involvement in the system. The student may enter the ET unit at his discretion, at any point during the semester.

Students utilize a printed program manual for direct involvement in the system. The manual includes a set of instructional objectives, and a set of sixteen (16) laboratory exercises. The exercises are directly related to the content of the LD unit. Also included in the program manual is an audio/visual and tutorial guide. This guide highlights slides, audio tapes and overhead projections which complement the learning pathways.

The instructor and the laboratory assistants hold a set of six test item packets. Five of these packets contain items which relate to specific topics which are covered in the LD, LB and LT units. One packet contains items which relate to all of the topics covered during the semester. The first five packets are designated, preliminary evaluative sections (ES); the sixth packet is designated the comprehensive evaluative section (CS).

System Flow: Entry into the system requires that a student possess a minimum background of high school biology, mathematics or chemistry. Concurrent enrollment in any of these at the college level is also acceptable.

There are a number of possible ways for a student to progress through the system. For example, he may attend each lecture while a particular

topical area is being covered; from his lecture experiences he may proceed to the special library component, where he may take advantage of selected program material articles and texts in order to augment his understanding of the discussion topic. The student may then proceed to the laboratory where he will conduct experiments, the nature of which is directly related to the discussion topic. The next step in his progression involves evaluation. He may take a preliminary examination which covers the discussion topic. If he achieves criterion performance, he then proceeds to commence his study of the next topic under discussion in lecture. If a student should achieve a score which is less than criterion on any of the preliminary ET units he must achieve criterion on the comparable section of the comprehensive unit in order to receive a passing grade for the course.

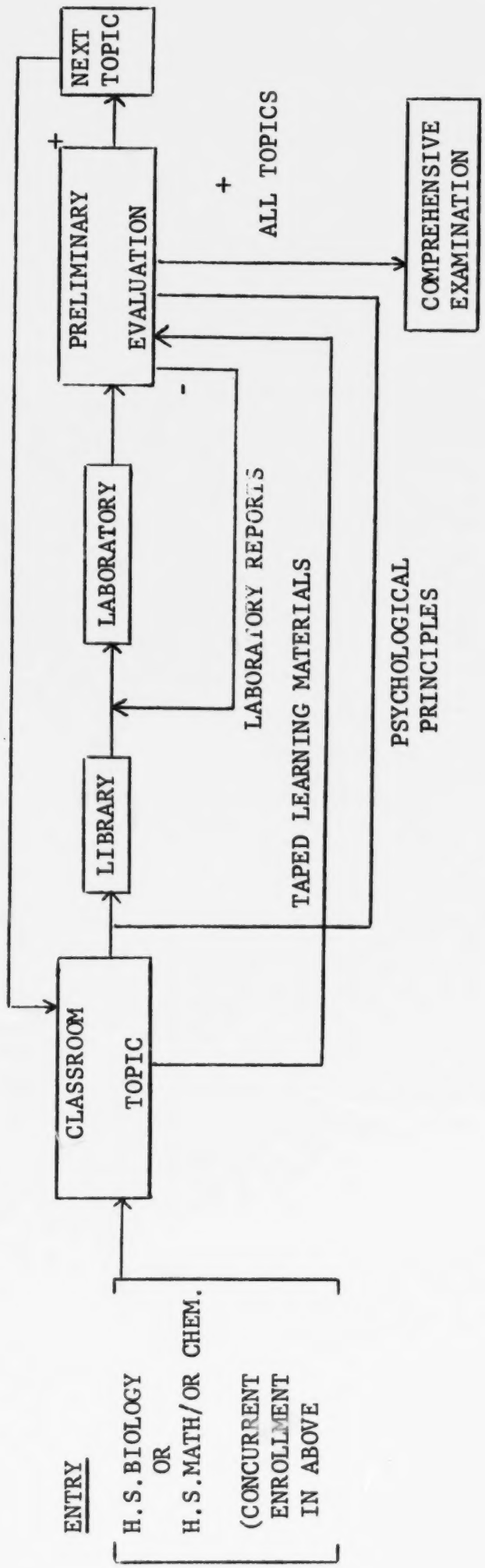
Another pathway through the system may involve the student not attending the lecture-discussion component but simply interacting with tape recordings of the sessions. He may also forgo taking any of the preliminary exams. In this situation, the student may take advantage of the laboratory and library components as he interacts with the tape recordings for each topic covered. He then takes the comprehensive examination when he feels that he is adequately prepared. The utilization of this pathway requires that the student make periodic contact with the instructor in order to get some degree of feedback concerning the adequacy of his study procedures.

Figure V shows the general approach to progression through the system which is suggested for the majority of the students.

A Note on Evaluation: Criterion in the ET unit is set at 70%. A student must answer correctly 70% of all of the items on the preliminary section and/or 70% of those on the comprehensive section. There are three possible grades: A, B, or C. A, corresponds to 90% performance; B, corresponds to 80% performance and C to performance percentages at criterion.

A student may take the comprehensive section twice. For example, if he should achieve 70% the first time and is not satisfied with this performance, he may attempt to improve his standing. He may also retest if he achieves less than criterion the first time. This is accomplished by allowing him access to the questions which he has missed (not the answers). He then reviews and studies these questions and takes the total section again.

Immediate feedback of performance is provided for the student. Whether he is taking the preliminary or the comprehensive examinations, his performance is immediately graded as soon as the examination is finished. (These results are then made available to the student). We feel that not only does immediate knowledge of results act as a positive motivating factor but also serves as a guide for corrective study.



SYSTEM - FLOW

FIGURE V

System Media: In the design the system attempts to integrate various media devices as the situation warrants. The developer was guided in this by the principle that all components should serve to augment a program rather than constituting the nucleus.

The audio/visual tutorial segment of the program involves a series of 300, carefully selected, commercially prepared, color slides and a set of twenty-five overhead color projections which were prepared locally to meet specific system requirements. The basic hardware device used in this segment is the 3M Brand Sound-Slide System. The sound-slide concept provides a completely automated presentation of pertinent visuals as well as recorded audio excerpts which explains the content of each slide simultaneously.

The audio tutorial aspects of the program includes tape recordings of each lecture which are made available to the student for his review. Approximately 30 fifty-minute lecture and discussion sessions are available. In his interactions in this program the student is not only given an opportunity to hear the lecture but also the questions asked in class and the ensuing discussion of the answers to these questions.

The psychological apparatus in the laboratory is used in the manner for which it was designed. For example, when the program calls for the student to memorize serial information, this information is placed on the Memory Drum. In this way, the student not only interacts with the theoretical content of the course but also obtains experience in the practical application of the various psychologically oriented devices. Thus, each student has the opportunity to have a "hands-on" experience with each device in the psychology laboratory.

Program Evaluation

The evaluation of the program consisted of the testing of the effectiveness of each of the system's components in the actual classroom situation. This was accomplished by conducting several elementary pilot studies over a period of three semesters. Following is a description of the designs and results of these studies.

Study #1 was undertaken during the 1968 summer school session.

Purpose: The purpose of this study was to test the effectiveness of laboratory experiences as an aid in the learning of the principles of first semester elementary psychology.

Subjects: Two groups of students served as subjects in this study. They were individuals who had enrolled for classes in elementary psychology. Two separate classes of 20 each were involved; a flip of a coin determined

which class would serve as the control group. Both the freshman and sophomore levels were represented by the members of these classes.

Procedure: Four one-and-a-half-hour lectures were scheduled for each of the eight weeks of summer school. These lectures were delivered in the traditional manner with a very limited amount of outside reading required. One-and-a-half-hour quizzes were administered on the fifth day of the week and the average of the grades from these quizzes constituted the final course grade. The same instructor taught both classes.

Both the control group and the experimental group followed this standard procedure for the first five weeks. In the fifth week, the experimental group was placed on a different schedule. Instead of attending lectures four days a week, they attended only three lectures. The fourth meeting was held in the Psychology Laboratory. This session involved demonstrations and experiments which were highly relevant to the topic under discussion. In most cases the students served as both experimenters and subjects in these demonstrations and experiments. Both groups took the same examination on the fifth day. Table I illustrates the overall experimenters design.

Table I - Research Design
Laboratory - Lecture Schedule

Group		Week							
		1	2	3	4	5	6	7	8
Control	Lecture	x	x	x	x	x	x	x	x
	Lab								
Experi-mental	Lecture	x	x	x	x				
	Lab					x	x	x	x

N = 40

Results: The basic aim in using the above arrangement was to determine if the inclusion of a single laboratory experience each week would have a significant effect on the average grades made by the experimental class. Table II shows the results of the experimental treatment.

Table II - Weekly Average Grade
of Control
and Experimental Groups

Average Grades in % of Items
Correctly Answered

Group	Week								
	1	2	3	4	5	6	7	8	
Control	73	70	77	71	72	71	70	75	$\bar{X} = 72$
Experimental	72	71	73	74	76	84	86	80	$\bar{X} = 76$

N = 40

Table II indicates that there was no significant difference in the overall average grades achieved by the control and experimental groups. However, close examination of the table reveals a somewhat dramatic shift in the performance on the part of the experimental group in the sixth week. This shift is toward a higher class average which was maintained through the last two weeks of the semester. Since neither class was aware of their participation in the experiment, it is felt that it is reasonable to assume that the observed changes were not the effects of an experimental phenomena such as a "Hawthorn" effect. The writer favors the conclusion that the observed improvement in performance by the experimental group may be attributed to the laboratory experiences.

Study #2

Procedure: During the 13th week of the fall semester of 1968 a six-item questionnaire was administered to a class of 150 students enrolled in the first semester of Elementary Psychology. This constituted an effort to assess student attitude toward the library and evaluation components of the system.

The questionnaire consisted of three questions which were designed to allow the students to respond anonymously concerning their attitudes toward the manner in which the resource material was selected and arranged in the library component. Three of the questions were directed toward an assessment of attitudes concerning our evaluative procedures. The six questions were as follows:

1. Do you use the resource material suggested in your workbook?
   _____ Yes _____ No

2. Do you feel that the material which is available in our library section has been helpful to your studying activities?
   _____ No _____ Yes

3. Do you feel that the availability of the resource material has made it easier for you to understand what transpired in lecture?

_____ Yes _____ No

4. Do you feel that the four tests which you have taken have been administered in a fair manner?

_____ No _____ Yes

5. Do you feel that the items on the tests were reasonably related to the information you received in lectures and covered in your studies?

_____ Yes _____ No

6. Would you prefer a test other than the fill-in type used in this class?

_____ No _____ Yes

Table III
Percentage of Responses on
Six-Item Questionnaire

Results:

Question	Percentage of Responses	
	Yes	No
1	98	2
2	89	11
3	80	20
4	99	1
5	90	10
6	70	30

N = 150 (100%)

The results of this survey seem to indicate that a major percentage of the students responding to the questionnaire felt that the resource material has: (1) a facilitative effect on their studying activities; and (2) a facilitative effect on the degree of understanding they achieved during lecture. In addition, most students felt that the tests were fair, related to the lecture material, and preferable to other kinds of tests.

Study #3. The purpose of this study was to determine the effectiveness of the instructional program when it was compared with a more traditional approach to teaching Elementary Psychology.

Procedure: During the spring semester of 1969, two classes were selected for study. One class met in the late afternoon and was taught by a female instructor. The instructor was not the originator of the instructional program, therefore, it was a new experience for her as well as for her students. The second class was taught by the originator of the instructional program, however, it was taught in the traditional mode. Both instructors used essentially the same lecture notes. These courses were taught on different campuses. The traditional approach was attempted in the community college setting. The program was conducted on the campus of a large university in Western Illinois. The classes were of unequal sizes. The community college class contained 120 students, while the university class contained 95 students.

Results: A comparison of the mean grades achieved by each of these classes revealed that the university class averaged 20 points higher on weekly examinations than did the community college class. Consequently, the overall final class average was significantly higher for the university group. Most important, however, was the fact that the university class was conducted in one quarter of a three-quarter year; whereas the community college class was conducted according to a semester approach. The main implication of this is that the program is applicable to the university population and secondly, it is appropriate for use in the quarter system approach to instruction.

Discussion - Projections

The main emphasis of the efforts in the development of the system described was upon the creation of a student-oriented program in Elementary Psychology. It is felt that limited success has been achieved in reaching this goal. The students working within the program have the opportunity to progress at individual rates. In addition, they are free to study behavior as it occurs in their immediate environments, via the psychology laboratory. However, there are constraints inherent in the instructional program which must be relieved before it can be adequately evaluated. The main constraint is that which involves the shock most students have expressed when they realize that they are relatively free to determine their own rate and mode of progress. Many students find this difficult to deal with in terms of their prior learning experiences. It may be feasible to think in terms of a more thorough program orientation period. This would involve allowing the student a trial period during which he experiments with a number of study strategies and decides upon the rate and mode of progression he shall attempt, before he enters the programed system.

The results of limited evaluative studies are certainly not conclusive. There are possibilities, however, that more intensive studies would reveal that certain aspects of a systems approach are greatly

superior to the traditional approach. One aspect which appears to be most outstanding is the speed with which a student is able to complete the first semester of psychology; the systems approach appears certainly to be superior in regard to this factor.

Sample of Unit III

"Elementary Psychology - An Instructional System", Volume I, Unit III: "The Description and Interpretation of Scientific Data", appears as Appendix C of this report.

CHAPTER VI

A SYSTEM FOR DEVELOPMENTAL ENGLISH

At first glance the English department seems an unlikely place for a pilot project using the systems approach. After all, systems analysis is an engineering concept which is frequently over-burdened by jargon and, on the surface, clinical in its precise organization and arrangement of parts. The English department, on the other hand, is heir to the humanistic tradition. Its members are products of a graduate background emphasizing the scholarly study of creative literature. They tend to look askance at anything smacking of behavioralism or technology. For them the memorable literature of our culture and the worthwhile writing of their students are frequently the result of an aberration rather than the carefully plotted order which would appeal to a systems analyst. Moreover the effect of such writing is total, not easily broken down into component parts. English instructors simply work in an area where the nature or the subject matter or the skills they wish to develop makes it difficult to achieve the quantitative measure which is the goal of systems analysts. Those familiar with the efforts of the College Entrance Examination Board to objectivize the evaluation of essay questions recognize the problem. So do those who have tried to quantitatively define the behavior associated with "appreciation of literature."

Despite these drawbacks, English should be a profitable area in which to investigate the potential of the systems approach. Certainly any innovation which might improve the effectiveness and the efficiency of the instructor would be welcomed. But more important is the size of the English department, usually the largest department in a junior college. Changes here would reach the greatest number of students. In selecting the course for the experiment, literature courses were immediately ruled out. The objectives in these courses are much more in the affective domain than in the cognitive, and the responses appropriate to a literature course are by definition sophisticated and qualitative. While the systems approach may work well in a literature course, especially insofar as it encourages independent study, it was ruled out as an initial effort. Besides, the major role of the English department in the community college is to improve student writing.

The Developmental English course seemed the best choice. Developmental English is a one-semester program required for students with transfer ambitions whose test scores or high school rank indicate, based on our past experience, that the student is unlikely to succeed in English Composition I. Students in the course fall into the lower third of their high school class, the lower quartile of the SCAT Verbal, or both. Some of the students in the course are also required to take a reading course concurrently because of low scores on the Davis Reading Test, Form A. Generally one can say that the students in the course have difficulty finding ideas and supporting evidence for writing and that they each have a distinct profile of problems in grammar and usage. Here the objectives could be more specifically defined than in a transfer composition course because the writing required was less sophisticated and shorter. Here, too, it would be easier to break the course into component parts and, on the basis of pre-tests, to assign students the work which was actually needed.

The first step in developing the instructional system was to arrive at behavioral objectives. Developmental English instructors have since drawn up behavioral objectives for the course, but at the start of this project the goal of the course was as broad as possible: prepare the student for English Composition I. Most instructors agreed that fulfilling this goal involved work in two areas: students needed help to focus on and organize ideas and to use the language correctly. Instructors had little to suggest when asked to comment on the course outcomes in terms of specific behavior. Their reaction was not surprising. Rather than view a course from a behavioral perspective, instructors tend to see it as the covering of a certain body of knowledge or as the meeting of broad goals which the instructor understands in the light of his experience in teaching the course. Interestingly enough, when an instructor begins to look at broad course goals in terms of specific student behavior he discovers that what once seem crystal clear is actually rather nebulous.

Writing behavioral objectives is a difficult task with several attendant dangers. There is always the danger of loosing sight of the ends by becoming too involved with the means. One can hang up on the form and content of objectives and never go further; there is such a thing as over-definition. Since objectives frequently become test items an instructor may begin by writing objectives which can be easily tested. In time, he will realize that these objectives are not leading to the behavior required by the course. This situation explains, to some extent, the decreasing numbers of remedial English courses which rely heavily on workbooks and objective tests in grammar rather than on the careful evaluation of student writing. Finally, the writer has to be careful that the objective is clear to the student who is enrolled in the course. If the student is only further confused, he would be better off without objectives.

The process of writing objectives, then, is one of continual questioning. Should the student be able to do this when he has completed

the course? How will he demonstrate he can do it? When will we both know that he has performed acceptably? Is the description of the behavior reasonably specific? Will the objective be clear to the student? The answers to these questions have to be weighed in turn against the amount of time available to the course, the number of students to be taught, and any other limitations of time, space, and money which impose themselves upon the course. In any case, by going through this analysis the instructor should come out with a new perspective on his course. If he stops the process right here with a careful understanding of what he expects students to do, then the experience will have made him a better teacher, more certain of what he is trying to do in the classroom.

Instructors are not the only ones who have difficulty adjusting to behavioral objectives. Students have some problems of their own. At first, they find it difficult to believe that they have been given all the test items and requirements of the course. It is an unfortunate statement on the conduct of our profession that students expect unexpected questions on examinations or the addition of course requirements as the semester progresses. In some situations, and developmental classes are one of these, the instructor has to be careful not to overwhelm the class with the objectives in the course. What has to be done in sixteen weeks may seem insurmountable to students during the first week. In the program described here, students are given a broad overview of the course and then are given the behavioral objectives periodically but well in advance of any deadlines associated with them. Initially students also may be surprised at the requirements for proficiency in the objectives. Those in remedial courses have frequently been allowed to slip through high school with marginal grades. Being required to achieve eighty or ninety per cent proficiency on a test seems impossible to them. However, if the first test items or writing assignments are carefully selected so as to challenge but not overpower, the student can gain fresh confidence in his ability to achieve.

As noted above, the behavioral objectives in a course often have to be tempered by limitations of numbers, time, and so forth. This course was no exception. The finances available to the college would not allow a reduction in the total load of the instructor, so the program developed would have to work toward more effective instruction of the existing load of 27-29 students per section (an instructor teaches four sections). There were also certain time limitations. The semester consisted of sixteen weeks of class. While the length of time the student had to be involved could be shortened, there was no formal provision for extending the semester to adjust to individual learning rates. The student's only alternative was to re-enroll in the course.

In resources, the program could take advantage of the English Learning Laboratory. This individualized instruction center for English and reading is staffed by two full-time teaching assistants, women with A.B. degrees in English. The assistants manage the lab and serve as tutors, counselors, and diagnosticians to supplement the efforts of the instructor. Students who

use the laboratory will find programed textbooks and machines as well as audio tapes and filmstrips dealing with matters ranging from basic grammar to sophisticated elements of style. Students may be assigned to the lab individually, in groups, or as a class.

The behavioral objectives for the course evolved over a period of time under these circumstances. When the system was first tested, it had about fifty objectives which students had to meet. Almost two-thirds of these were for test items. For example:

> Given five statements which use examples to support a generalization, the student will identify fair and unfair use of examples. He will also explain whether he feels the example is unfair because it is irrelevant to the generalization or because it is non-representative. This will be done in the testing situation with 80% accuracy.
>
> Given three paragraphs, the student will indicate which of the following problems appear in each paragraph:
>
> no topic sentence
> no development of the topic sentence
> no specific detail
> inclusion of irrelevant detail
> inconsistent paragraph development
>
> This will be done in the testing situation with 80% accuracy.

In time it became apparent that while these were appropriate items, they were not directly relevant to the student's own writing. As evaluative devices they were draining away time that could be better spent writing papers and discussing those papers with the instructor. As a result most of these test items have been turned into dittoed classroom exercises which lead to the achievement of objectives calling for particular writing assignments. For example, rather than call upon the student in a test to list the five steps used to preview a book and to tell what one should learn from each of them, he is now simply required to write a preview:

> The student will write, outside of class, a report in which he previews a textbook used in a course other than English. The report will tell what he has discovered as a result of following the five steps used to preview a book. The order of items in the report will follow the order of parts in the textbook being previewed.

Thus, the student now meets only about twenty objectives, most of which call for writing.

Initially, objectives were given in lists in the chronological order in which they were to be completed. While this approach served to guide

the progress of the student, it made the program look like a series of small disjointed steps rather than an organized plan which could lead to better writing. Now the presentation of objectives follows a suggestion made in an article by Albert A.Canfield.[6] Pointing to the divergent views held by those favoring behavioral objectives and those favoring the traditional use of broadly stated goals to guide education, Canfield suggests combining both goals and objectives into one statement and, perhaps, including a statement showing the rationale for requiring that goal and particular objectives. Following this suggestion eight broad goals for the course have been identified:

1. The student will develop the habit of writing frequently.

2. The student should be able to use the resources available to him. These include his textbooks, his instructors, the English learning laboratory, the college library, and his community.

3. The student should develop an awareness of detail in the world around him and an understanding of organization in material which he hears and reads.

4. The student should be able to make generalizations about a given topic.

5. The student should be able to select and organize detail to support a generalization.

6. The student should be able to write a well organized paragraph.

7. The student should be able to write a paper which develops an idea he has formulated. The paper should be well organized and reasonably correct in its use of language.

8. The student will gradually improve his ability to use his language at the level normally expected of a college student.

Then under each of these goals the student finds the objectives identifying the behavior required of him if he is to meet that goal. For example, under the third goal the student is required to sharpen his observation as one requirement:

> The student will write in class a paper in which he lists all of details he can see in an object given him by the instructor.

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[6]"A Rationale for Performance Objectives," Audiovisual Instruction, 13, (Feb., 1968), 127-129.

He might be given a thumbtack or a pen as the subject of this assignment. Later under the fifth goal he is given the following objective:

> The student will write in class a short paper in which he makes a general statement about a specific object and supports that statement with specific sensory impressions. The paper should contain no detail which does not support the general statement and it should be free of any major errors in sentence structure.

Here he might again be given the pen, asked to make a generalization about it such as "This pen is badly worn", and expected to select specific detail which supports the generalization.

The student also finds under each goal and with most objectives a rationale which explains the part that goal or objective plays in the total course. In pulling together course material, objectives and exercises related to them are bound together under the goal which they meet. The student, then, receives a component rather than just a list of objectives.

After the objectives were formulated a decision has to be made as to the form which the course would take. The largest influence in reaching this decision was a report of the initial experience of Oakland Community College in developing an instructional system for remedial English. The college originally set up a remedial program which involved a good deal of independent study and left attendance at class sessions optional. As reported by Merle H. Smith, the results were dismal: sixty per cent of the students failed to satisfactorily complete the course. The students at Oakland, who were much like those at Meramec, were ill-prepared to handle the freedom and demands of such a program.[7]

As a result, it was decided that the system being used for developmental English would use the normal classroom situation. In this situation the student would not find himself overcome by an unfamiliar setting and his progress could be informally gauged by his presence and attitude in class. The class sessions are usually very structured with students frequently receiving active-involvement sheets to guide notetaking and with the major part of class time devoted to group involvement in writing problems such as narrowing a topic, selecting evidence, or editing a first draft. Class sessions are also used for in-class writing. In one successful group of sessions students were expected to write several paragraphs of varying construction. This work was done in class with students receiving comments from the instructor as they completed each paragraph. The software developed particularly for this system includes the behavioral objectives, their supporting rationales and tests, as well as exercises which filled needs not met by textbooks used in the course. Textbooks each semester included a handbook and a guide for writing. The Practical English Handbook, 2nd Edition, by

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[7] "The Developmental Program within the Systems Approach to Instruction," in Systems Approaches to Instruction in the Open-Door College, B. Lamar Johnson, ed. Junior College Leadership Program, Occasional Report No. 9. UCLA, 1967, Pp. 63-67.

Watkins et al. (Houghton, Mifflin, 1965) served as a reference in grammar and usage. The chapters on the paragraph and style were the only ones used in class. Cowan and McPherson's Plain English Please, 1st Edition, (Random House, 1966) was used one year as a guide. Fleming and Glatthorn's Models for Composition 2 (Harcourt, Brace, and World, 1968) was used the next year. Both books call for active response from the reader. Stimulating, sharing, and discussing these responses made up a major part of classwork. The point here is that there are already available any number of well-written texts which the instructor can draw from once he knows where he's going (behavioral objectives) and when he'll know he's there (post-tests). An instructor who wants to develop a system for his course does not have to start from scratch. In fact he may find the objectives and effectiveness of an existing system so satisfactory that he will have to do a minimal amount of developmental work.

The class usually meets as a whole except when dealing with objectives under the eighth goal, improving grammar and usage skills. Since student profiles on problems in grammar and usage vary from individual to individual, the class is narrowed to those who need to work in a particular area. For utility sake grammar problems are broken into several distinct areas: recognizing sentences, pronoun usage, verb usage, syntax, and basic punctuation. Before the area is discussed, the class is given a pre-test on that area. Those achieving the required proficiency are then excused from class on the day or days that the subject is discussed. This procedure has resulted in as few as three people being excused from a class of 28 to as many as eighteen being excused. The time-off provision serves as an incentive to the student who already knows the material and it does not penalize the student who needs help in that area. Grammar work is reinforced by the cumulative addition of restrictions on grammatical errors in the objectives for papers. Initially in the semester a student's papers are not judged adversely for grammatical errors. Later, though, after the discussion on recognizing sentences his papers can contain no more fragments or run-ons. After further grammar discussions his papers can contain no sentence errors, no errors in pronoun usage and so on. By the end of the semester, the student is required to write papers free of major grammatical errors and, in many cases, is able to do so because he has built up a resistance to such errors.

The class also meets periodically in the Learning Laboratory, usually to do revisions of graded papers. The instructor and the teaching assistants are able to circulate freely and give students assistance as they ask for it. The laboratory is also used for work outside of the class period. When a student does not meet the required proficiency on a test item he is sent to the lab to review the material in textbooks, on tapes, or in a tutorial session with a teaching assistant. Then he retakes test item and continues the process until he meets the requirement of the objective. As might be expected, initial student reaction to this procedure is usually negative, but once they have been through it attitudes usually change. Students find that if they work at the subject matter they can meet

objectives. More than one student has pointed out that no one ever cared enough about how well they learned to make them keep working at a problem until they had mastered it.

Students are expected to complete the course during the semester. As indicated earlier there is no provision which allows a student to work beyond the sixteen-week period without requiring him to re-enroll in the course. However students who complete the course objectives before the end of the semester may test out of the course by achieving at least a B on the final examination. The final consists of four essay questions. These questions are selected at random for a list of twelve questions which summarize the work of the whole semester. Answers are evaluated equally on content and form. Since the questions are picked at random from a list which the student has well in advance, there is no problem in test security nor does the instructor have to spend much time developing alternate tests. During the fall 1969 semester, about a third of the class was able to test out of the course before the last week of class.

Since objectives varied widely from instructor in instructor it was decided to use final grades in English Composition I as an indicator of success. It was not likely a developmental student would have the same instructor in English Composition I as he had in Developmental English. Moreover, the purpose of Developmental English was to prepare its students to pass the college parallel course. In this grade comparison results were mixed.

In Fall 1967, students in two Developmental English sections taught by Joseph Dunne were compared with students taught in two other sections of Developmental English which were randomly selected. Students in all sections were taught traditionally, without behavioral objectives and without pre-testing. The comparison group had a higher retention rate, but about the same number of students returned to take English Composition I and of those who took it about the same percentage passed with at least a C. (See page 47). During Fall 1968, two sections were taught using the systems approach described in this chapter. These were compared with two randomly selected sections taught normally. Once again the results were about the same. The classes using the system described here were also compared with a class using a system developed by Mrs. Maxine Mosley of Meramec Community College. This class has a writing laboratory approach; students in this section write every class session while the instructor grades in individual conferences at the front of the room. A student continues writing a particular assignment, such as an essay of comparison, until it meets the criteria established in the objective for it. Here, too, the results were about the same.

The conclusion, not surprisingly, is that there is no major difference between this approach and other approaches when English Composition I final grades are compared.

The value of this approach rests in its ability to adapt to student needs. The student is given the instruction he has shown he needs. He is excused when he can demonstrate proficiency. He has the opportunity to pass out of the course before the end of the semester. The result is a positive attitude toward the course. During Spring 1969 students in one section using the approach were asked to voluntarily complete a questionnaire on the approach. (See pages 48-49). Students reacted favorably to behavioral objectives, encouraging their use in other courses. Not surprisingly they favored release from class when proficiency has been demonstrated. Surprisingly they also favored having to work at an objective until they met the required proficiency.

What directions are suggested by this project? The first is that this method is no panacea. As far as grades are concerned it does not outperform traditional methods. The project does suggest, though, that with concentrated help there are a number of students who could complete the course in less than the time we now use. This experience has led a number of English instructors to consider the development of an open-ended course entitled Freshman English. The course would include Developmental English and the two semesters of English Composition. Any student in a college transfer program would receive six hours of transferable credit when he demonstrated the behavior called for in the behavioral objectives for freshman English. Students who come well-prepared may be able to meet these objectives in a semester's time. We could expect most students to complete the objectives within two semesters. Students who needed remediation, and this need would be determined by diagnostic pretests, would probably take longer to complete the program. In any case, students would be taught only what they needed. They would all be enrolled in the same course and potentially for credit; thus, minimizing a major student complaint about Developmental English. There are obviously a number of problems here, most of them involving administrative matters. However, there is a good deal of promise in the proposal, and experience and materials developed in this system as well as other innovative work at Meramec Community College should help this plan to become a reality.

STUDY OF FINAL GRADES IN ENGLISH COMPOSITION I

Courses	(1) 001 Total Enrolled	(2) 001 Passed (D or better)	Percent passing (2/1)	101 Grades) A	B	C	D	F or W	Percent taking 101 and passing (C or better)
Fall 1967									
Author's (2 sections)	55	40	73%	3	9	20	2	4	84%
2 random sections	56	50	89%	2	18	18	2	5	85%
Fall 1968									
Author's (2 sections)	52	44	85%	2	7	17	3	7	72%
2 random sections	52	47	90%	2	7	16	5	4	74%
writing laboratory	27	24	89%	1	8	7	4	3	69%

Questionnaire given to a class of 23, Spring 1969. Nineteen students voluntarily responded.

1. Have you taken other courses at Meramec which use behavioral objectives?

   Yes 4 (they had taken Intermediate Algebra)

   No 15

2. During the course of the semester you have been given your assignments and test items in the form of behavioral objectives. Have these objectives helped you on tests and assignments?

   Yes 17

   Sometimes 2

   No 0

3. When you did not meet objectives on a test you were expected to work in the laboratory until those objectives were met. Should a student be required to meet all objectives?

   Yes 12

   Sometimes 0

   No 2

4. Should the practice of requiring students to meet objectives be extended to all or almost all of the courses at Meramec?

   Yes 13

   No 5

5. When students met objectives relating to grammar in the pretest for the objective they were excused from class. Is this a wise policy?

   Yes 16

   Sometimes 2

   No 1

6. Were you ever excused from class on the basis of a pretest?

   Yes 12

   No 7

7. This was a course which the English Department required you to take before allowing you to enroll in Composition I. With which of these statements do you agree?

   Departments should be allowed to restrict who goes into a course. 9

   Departments should allow students to take the courses they want to take. 9

APPENDIX A

AN EVALUATION OF THE CHEMISTRY SYSTEM BY GLENN R. BAAS, A FORD FOUNDATION TEACHING INTERN AT MERAMEC COMMUNITY COLLEGE.

EVALUATION OF THE AUDIO-TUTORIAL GENERAL CHEMISTRY I

Glenn Roger Baas
Teaching Intern
December 1969

This evaluation was conducted in order to determine the success of the audio-tutorial system (AT) as used in General Chemistry I at Meramec Community College. A secondary goal of this investigation was to find out from student opinion how AT has affected their study habits, and also to determine the strengths and weaknesses of the program.

The evaluation form was given on Friday, December 5. The form was passed out with the quiz and the students completed it and returned it by the end of the period. The questionnaire was completed by 75 students.

An item analysis of the results is given below.

For the following questions the possible responses were: 1--almost always, 2--usually, 3--sometimes, and 4--almost never.

Results of Questionnaire

		1	2	3	4
1.	Do you attend seminar?	49	11	12	3
2.	Do you depend on the seminar as your only source for test preparation?	1	4	22	47
3.	Do you have the unit completed before you attend seminar?	25	21	17	11
4.	Do you benefit from the small group seminars?	47	10	15	3
5.	If the seminars were optional would you attend?	34	19	13	8
6.	Are the tapes understandable and interesting?	16	36	17	4
7.	Have you used the stations in the library?	27	13	23	12
8.	Do you use the tapes each week?	44	16	7	8
9.	Do you always listen to the complete unit before the test?	48	14	6	8
10.	Do you use materials from the library or texts made available in the lab?	25	15	18	17
11.	Do you read your textbook with each unit?	15	11	24	25
12.	Do you use the scripts which are placed in the lab?	50	11	8	5
13.	Are these scripts helpful?	61	9	3	2
14.	Do you think more could be gained from a lecture rather than from the tapes?	9	7	29	27
15.	Do you do your lab experiment each week?	34	22	16	4
16.	Have the experiments been interesting to you?	19	30	17	9
17.	Do the test questions generally cover what is in the objectives?	33	30	9	2
18.	Are the instructors available most of the time?	42	24	7	0
19.	Have the instructors been helpful?	48	20	4	1

	yes	no	?
20. Is it necessary to have a textbook if scripts are available?	19	31	23
21. Do you like the practice of a quiz every week?	66	3	5
22. Would you advise your friends to take the course?	55	6	12

23. Give an estimate of the hours you spend on each unit.

Hours spent:	0	2	3	4	5	6	7	8	9	10	11-15	16-20
No. Students:	1	1	5	7	8	8	10	7	12	7	2	5

24. If you have taken the make-up tests how many additional hours of study do they require each week?

Hours:	0	1	2	3	4	5	6	7
Students:	1	9	23	16	4	4	1	2

25. What was your midterm grade? A--20 B--29 C--22 D--2 F--1
What final grade do you expect? A--23 B--31 C--18 D--1

26. What is your rating of the course in comparison to other courses you have taken?
Above average--53 Average--19 Below average--2

27. What is your rating of the instructors in comparison to others which you have had?
Above average--59 Average--15 Below average--0

<u>What would you change to make the course better?</u>

"Back to lecture system, more comprehensive tests which require essay rather than multiple choice, audio-tutorial does not challenge the students but merely becomes a memory course."
"More lecture--deeper understanding of problems is needed--not just pieces of things that we are to remember as facts but should require more general understanding of concepts."
"Forget about the requirement of handing the workbooks in to be graded."

NOTES REGARDING MR. GLENN BAAS' EVALUATION

An analysis of the raw data extracted by Mr. Baas has been expanded by recording student response as a function of midterm grades. This analysis refers to the following questions:

I. Are the seminars useful?
(Student response to questionnaire items 1 and 4 was used as answers to this question)

II. Are the audio taped materials useful?
(Student response to questionnaire items 6, 8 and 9 was used as answers to this question)

III. Are the written materials (texts, scripts, library) useful?
(Student response to questionnaire items 10, 11, 12, and 13 was used as answers to this question)

IV. Do you perform the assigned laboratory experiment and are the laboratories interesting?
(Student response to questionnaire items 15 and 16 was used as answers to this question)

V. Are the instructors available and helpful?
(Student response to questionnaire items 18 and 19 was used as answers to this question)

VI. How much time do you spend per week on chemistry?
(Student response to questionnaire item 23 was used as answers to this question)

(2)

Average Weighed Usefulness of Seminar 1.49 (between Very & Usually)

I. Usefulness of Seminar

Midterm Grades	Very 1	Usually 2	Sometimes 3	Rarely 4
A	11	7	3	
B	26	3		
C	14	1	7	
D	2			
F				1

Average Weighed Usefulness of Tapes 1.86 (Usually)

II. Usefulness of Taped Material

Midterm Grades	Very 1	Usually 2	Sometimes 3	Rarely 4
A	13	4	3	1
B	19	9	1	
C	4	13	4	1
D		1		1
F				1

Weighed Average 2.25 (Usually)

III. Usefulness of Written Materials

Midterm Grades	Very 1	Usually 2	Sometimes 3	Rarely 4
A	7	8	6	1
B	5	16	8	
C	3	5	12	1
D		2		
F				1

Weighed Average 1.9 (Usually)

IV. Usefulness of the Laboratory

Midterm Grades	Very 1	Usually 2	Sometimes 3	Rarely 4
A	13	6	1	1
B	15	9	4	1
C	6	6	10	
D		1		1
F				1

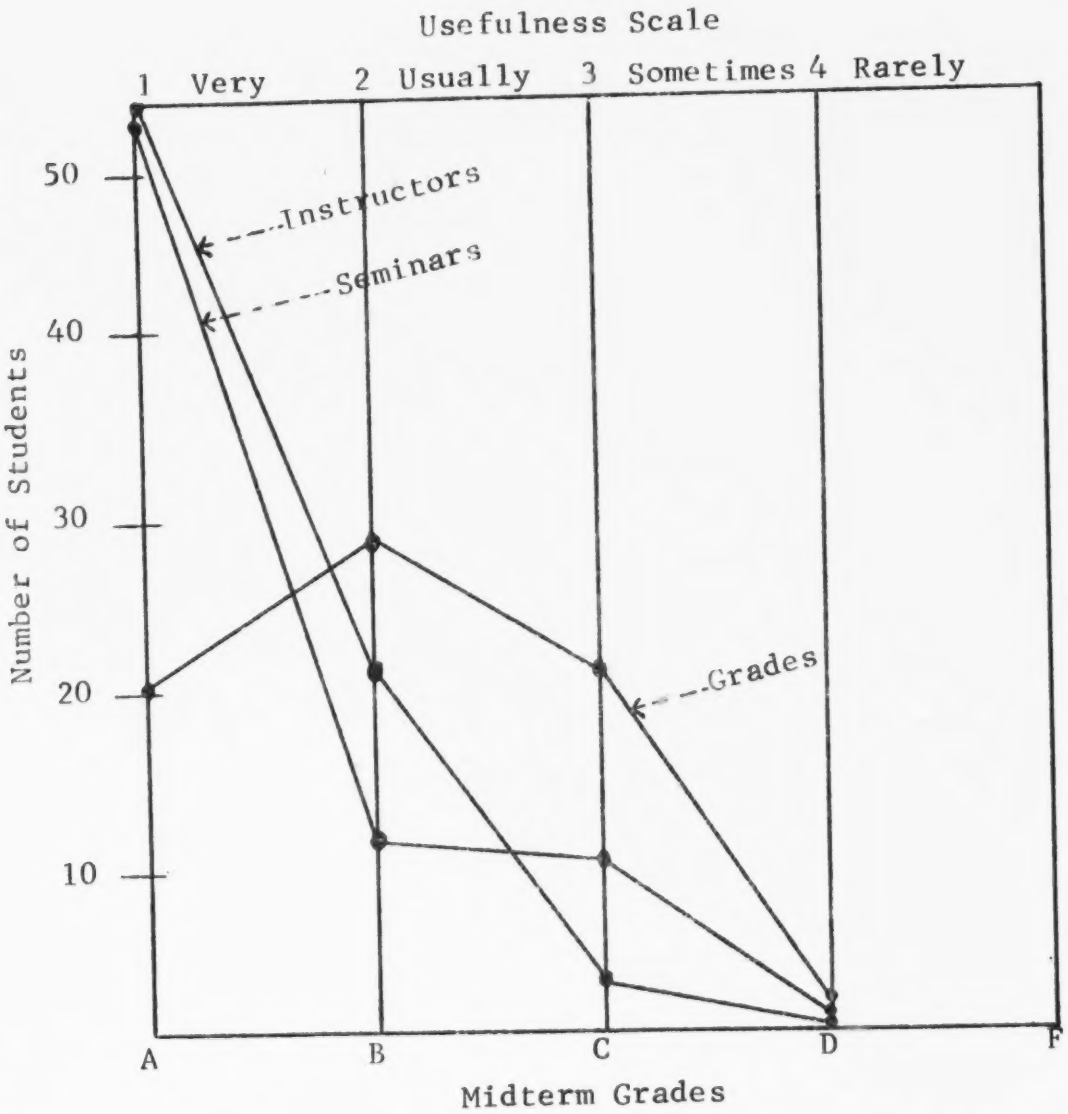
Weighed Average 1.43 (very)

V. Usefulness of the Instructors	Very 1	Usually 2	Sometimes 3	Rarely 4
A	13	6	2	
B	21	9		
C	19	6	1	
D	2			
F				1

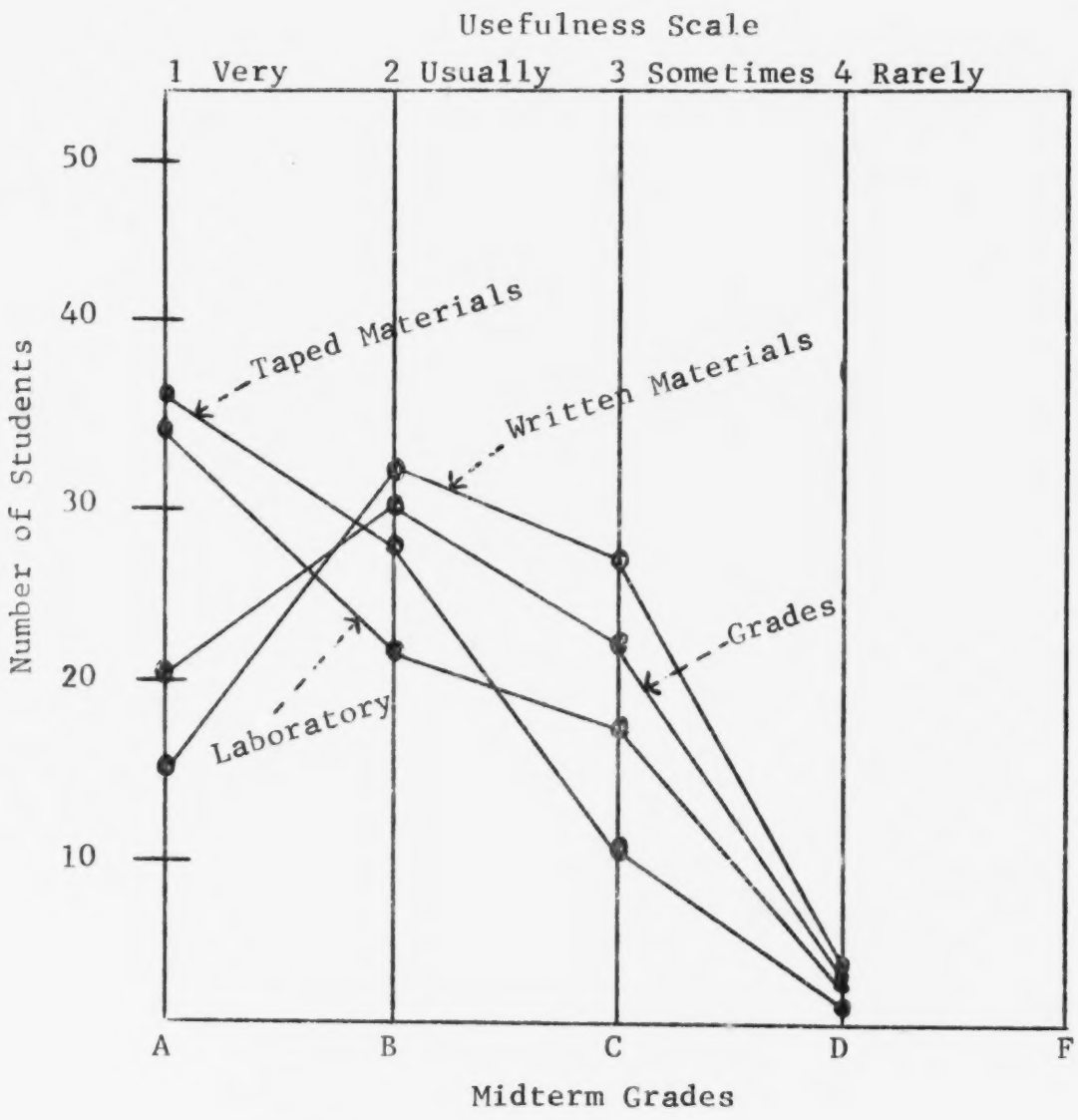
Average Study Hours per Week = 7.8 hours

VI. Study Hours Per Week	Below Average 1-5	Average 6-8	Average 9-11	Above Average 12-20
A	3	10	5	2
B	9	7	8	3
C	8	6	6	2
D			2	
F				

Comparison of student response to the usefulness of two systems components emphasizing human interaction with corresponding midterm grades.



Comparison of student response to the usefulness of three systems components emphasizing non human interaction with corresponding midterm grades.



Recording of the above data indicates that students generally feel that the human interaction, components of the learning system, instructors, and seminars, are the most useful in helping students achieve the course objectives. Students record that the non human interaction, taped material, laboratory experiments and written materials, are usually less useful than human interaction. However, when the various system components are plotted on the same graph as earned midterm grades the correlation between the non human interaction and earned grades appears to be higher than the correlation between human interaction and earned grades.

APPENDIX B

REPRESENTATIVE MATERIALS FROM DR. R.L. HEIDER'S WORKBOOK, UNIT XIV "ELECTROCHEMISTRY".

U N I T X I V

W O R K B O O K

ELECTROCHEMISTRY

BIBLIOGRAPHY

EDUCATIONAL SPECIFICATIONS

FIGURES

EXERCISES

EXPERIMENTS

ANSWER SHEET

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ELECTROCHEMISTRY

BIBLIOGRAPHY

Texts

Nebergall, et al:	General Chemistry, 3rd Edition Chapter 19
Nyman & King	Problems for General Chemistry & Qualitative Analysis Chapter 19
Keenan & Wood:	General College Chemistry, 3rd Edition Chapter 18
CBA	Chemical Systems, 4-4 and 4-5; Chapter 14
Sienko & Plane:	Chemistry, Principles and Properties Chapter 13

Paperbacks

Lyons, E. H., Jr.	Introduction to Electrochemistry

Programed Materials

Runquist, et al:	Principles of Chemistry Chapter 9
Sacerdote:	General Chemistry - A Programed Review, Unit 27

Films and Visual Aids

CHEM Study Film, no. 4133, Electrochemical Cells
McGraw-Hill Chemistry Series: Voltaic Cells
: Concentration Cell-Nermat Equation
: Electrolysis

Popular Science Filmstrips for Chemistry: Electrochemistry
Oxidation-reduction

ELECTROCHEMISTRY

EDUCATIONAL OBJECTIVES

The student will be able to

. . . 1. Discuss the flow of charge through a conducting wire or through an ionic solution, recognizing chemical changes that may occur

. . . 2. Define, and give an example of electrolysis; recognize that, industrially, magnesium and aluminum are produced by electrolytic processes

. . . 3. Draw a schematic sketch of the electrolytic process for manufacturing aluminum metal

. . . 4. Describe a voltaic cell, and draw a detailed sketch of the Daniell cell

. . . 5. Recognize, and differentiate between a chemical reaction, e.g., $Zn + Cu^{++} \longrightarrow Zn^{++} + Cu$, as a means to convert chemical energy to heat energy or electrical energy

. . . 6. Define, and use in calculation, the following expressions: amperes, ohms, volts, coulombs, Faradays, and one mole of electrons, 6.02×10^{23} electrons

. . . 7. Define, and differentiate, between
oxidation and reduction
anode and cathode
and recognize that oxidation takes place at the anode

. . . 8. Discuss "half-cell reactions" and be able to write such reactions as either an oxidation equation or a reduction equation

. . . 9. Discuss Experiment I: Energy Conversion in Chemical Systems, apparatus used, how to convert chemical energy to either electrical or heat energy, conversion of chemical energy from one system to effect a chemical change in a second system.

. . .10. Recite and apply Faraday's Law to calculate the quantity of a metal obtained during electrolysis, assuming 100% efficiency

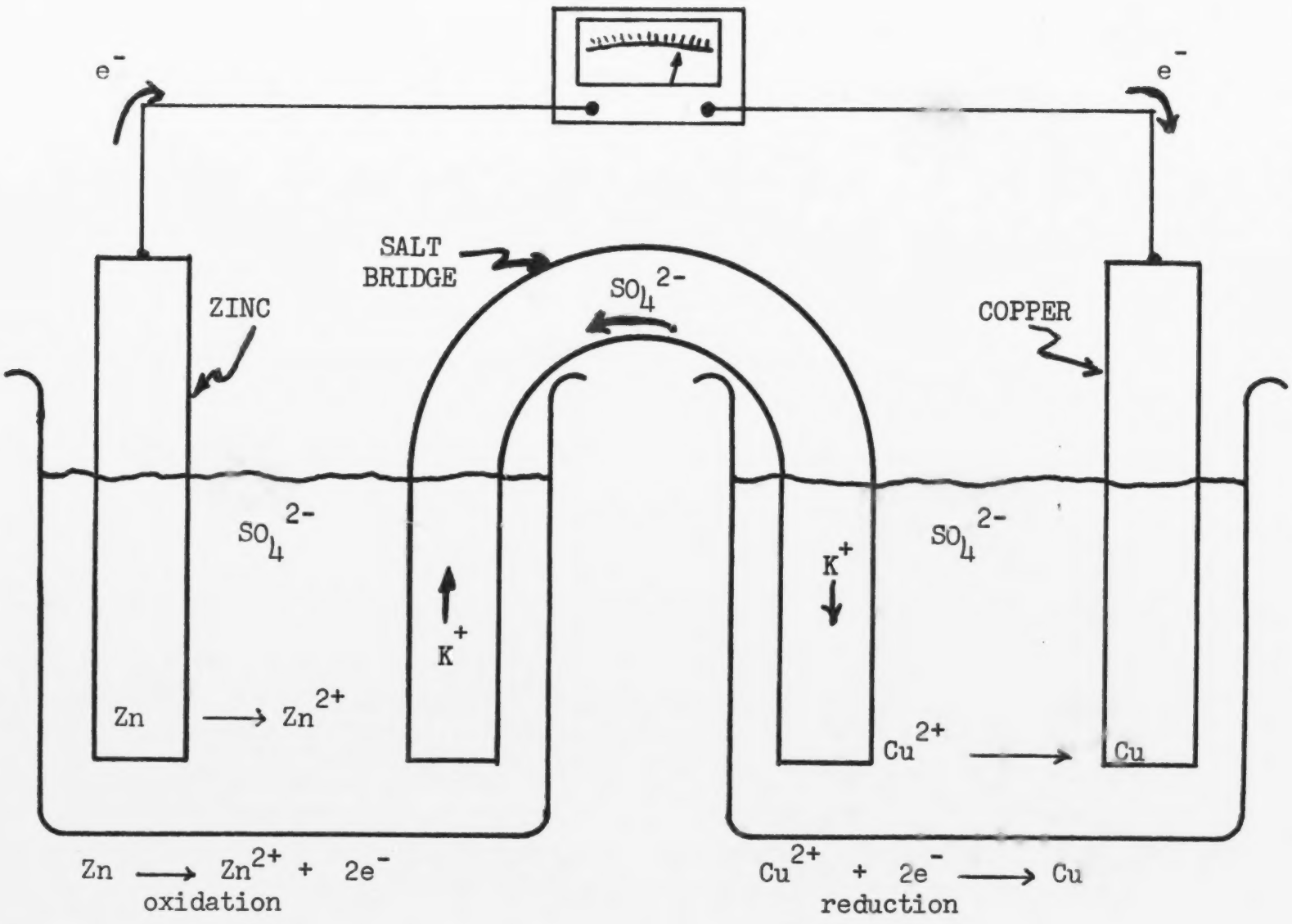
. . .11. Define, and be able to calculate, the gram-equivalent weight of an element

. . .12. Balance oxidation-reduction (REDOX) equations (in either acidic or basic solutions) using the (a) ion-electron method, or (b) the oxidation state method

. . .13. Given a redox equation, sketch a Voltaic cell which might be constructed using that equation as the source of chemical energy

FIGURE 2

A VOLTAIC CELL



$Zn \longrightarrow Zn^{2+} + 2e^-$
oxidation

$Cu^{2+} + 2e^- \longrightarrow Cu$
reduction

EXERCISE 1

1.1 A current of 2.0 amperes was measured in a circuit powered by a 12 volt storage battery. What was the resistance of the circuit?

1.2 If the current above remained constant and was permitted to flow for 10 minutes, how much electricity was used, measured in coulombs?

1.3 How many electrons flowed through the circuit in (1.2) above during the 10 minutes?

1.4 How many moles of electrons passed through the circuit?

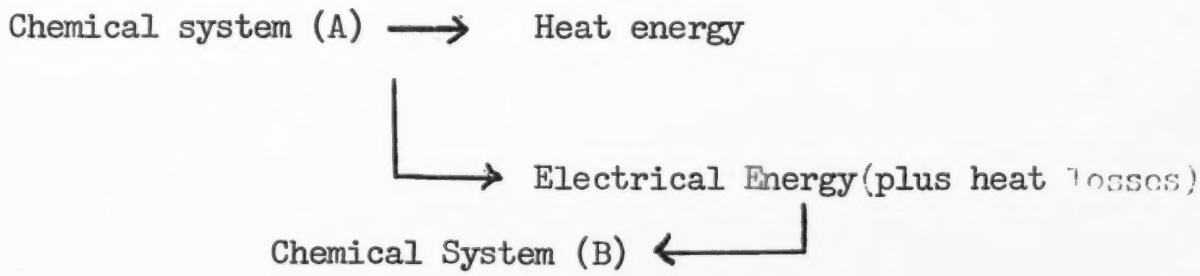
EXPERIMENT I

ENERGY CONVERSION IN CHEMICAL SYSTEMS

The system we shall investigate involves the reaction of metallic zinc with copper sulfate solutions

$$Zn + CuSO_4(aq) \longrightarrow Cu^o + ZnSO_4(aq) + \text{energy}$$

The energy that is released from this interaction may be in the form of heat or mainly electrical energy. This electrical energy, in turn, may be used to effect other chemical systems to bring about chemical reactions. Schematically, we might represent this as follows:



A. Thermochemical Study

Using the calibrated foam cup calorimeter equipment employed in Unit XIII Thermochemistry, place 175 ml. of 0.5 M. $CuSO_4$ solution in the cup. Determine the temperature of the solution, using a thermometer reading to 0.1^oC. Be careful not to conduct body heat to the thermometer by properly insulating your hand before you handle the thermometer and immerse the thermometer to the ring etched around the stem for obtaining greatest accuracy.

Now weigh 1.5 - 1.6 g. of zinc powder to 0.01 g. on a balance. Record the temperature of the $CuSO_4$ solution. Be sure that the solution has been stirred continuously for at least 5 minutes with temperature readings taken every minute. Add the zinc powder, continue stirring and take time - temperature readings every 0.5 minute for 5 minutes and then every minute

for an additional 10 minutes. To effect good chemical reaction it is necessary to stir the solution continuously. Allow the copper mud (brown-black in color) to settle to the bottom of the cup, then carefully decant the liquid and wash the copper metal residue with 10-15 ml. portions of distilled water until no further blue color can be observed. Discard the wash waters.

Rinse the residue into a small beaker by means of a stream of distilled water, using about 20-25 ml. total (no more!). Now add an equal volume of 5M H_2SO_4 and stir the acid-copper mixture for 4-5 minutes to insure that any unreacted zinc is removed, e.g.

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

Decant the H_2SO_4 solution and again wash the copper mud with 6 portions of 25 ml. distilled water. Finally the copper is filtered on to quantitative filter paper and dried in an over or under an infra-red lamp to constant weight.

Calculations

The ΔT for the reaction is derived from a plot on cross-section paper of your temperature-time data. (Refer to calibration of a foam cup calorimeter)

Recall that Q = (Mass) (ΔT) (heat capacity), where Q = calories

The density of a 0.5 M $CuSO_4$ solution is 1.08 g/ml. and the heat capacity is 0.95 cal/gram - ^oC.

Since we have the mass of the copper precipitated, we can convert this to moles of copper. Further, one mole of zinc is equivalent to 1 mole of copper based on the stoichiometry of the equation, $Zn + CuSO_4 \longrightarrow Cu + ZnSO_4$. Finally

ΔH (cal/mole) = Q/moles of zinc reacted ΔH is expressed in kcal/mole

From your data calculate the ΔH of the reaction.

The reason for basing the calculations on copper rather than on the mass of zinc used is that zinc powder is seldom more than 98% pure whereas the copper formed has much higher purity and has been acid-washed to attain higher purity.

ANSWER SHEET

EXERCISE 1

1.1 6.0 ohms

1.2 1200 coulombs

1.3 $7.5 \times 10^{21} e^-$

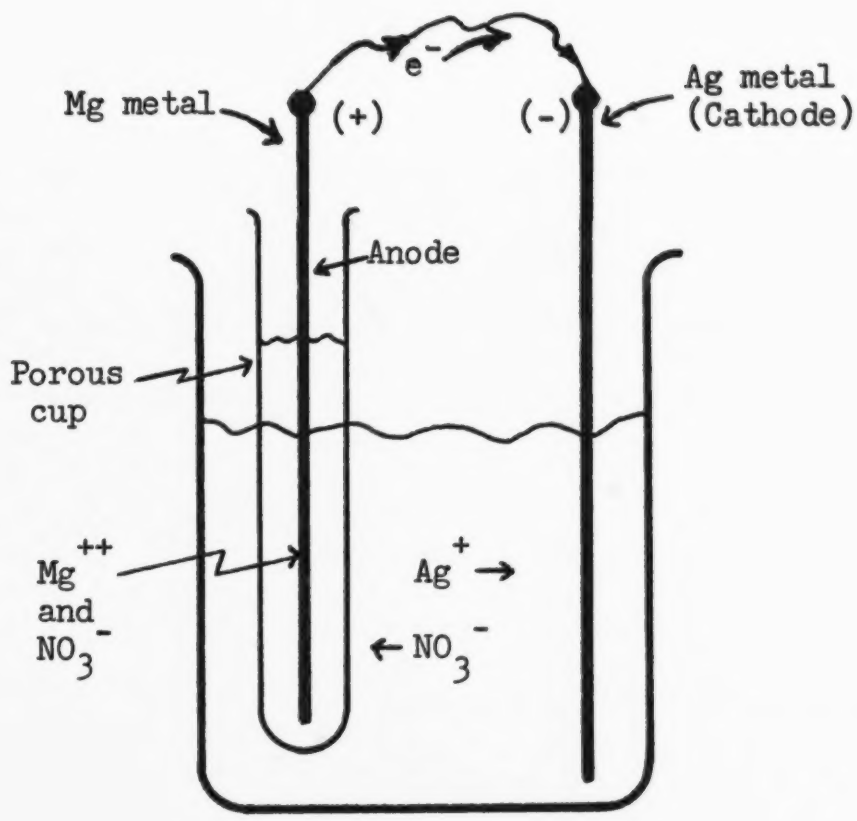
1.4 1.2×10^{-2} moles

EXERCISE 2

2.1 $Mg \longrightarrow Mg^{++} + 2e$ (oxidation); $2Ag^+ + 2e \longrightarrow 2Ag$ (reduction)

2.2 Magnesium; Silver ion; 2 moles; Magnesium; Silver-ions.

2.3



Anode: $Mg \longrightarrow Mg^{++} + 2e^-$

Cathode: $2Ag^+ + 2e \longrightarrow 2Ag$

APPENDIX C

SAMPLE OF L. WENDELL RIVERS' "ELEMENTARY PSYCHOLOGY - AN INSTRUCTIONAL SYSTEM", VOLUME I, UNIT III: "THE DESCRIPTION AND INTERPRETATION OF SCIENTIFIC DATA".

U N I T I I I

The Description and Interpretation of Scientific Data

I. Unit Objectives

A. You should [Study] the names and functions of the scales of measurement presented in Table V of this unit.

B. You should [Memorize] the differences between these scales.

C. You should be able to [Write] the definitions of the Greek symbols shown in Table VI of this unit.

D. You should be able to [Compute] the following statistics:

1. The Mean
2. The Standard Deviation
3. A Standard Score
4. Coefficient of correlation (Product moment)

E. You should be able to [Construct] the following graphs:

1. A frequency Distribution
2. A frequency Histogram
3. A frequency Polygon

F. You should [Memorize] the basic five steps in statistical inference which are presented in Table VII of this unit.

II. Resources for Unit III

A. Lecture - The material for this unit will be presented in lectures 6, 7, 8, and 9.

B. Library

1. Amos, Brown, and Mink, "Statistical Concepts" - (all relevant chapters).
2. Kendler, "Basic Psychology", Chapter 3.

3. Ruch, "Psychology and Life", 7th edition, reference manual A.

4. Andreas, "Experimental Psychology", Chapter 3.

C. Laboratory

1. Sound on Slide Apparatus - McGraw-Hill slides 242 thru 252.

2. Overhead Projections 1-3.

3. Tape recordings of lectures 6, 7, 8, and 9 are available for your review.

TABLE V - UNIT III

SCALE	FUNCTION
Nominal	Classification: This is the lowest level of measurement. It yields the least information of any scale of measurement. Numbers are used to simply distinguish one individual from another.
Ordinal	Classification and order: This scale distinguishes one individual from another and tells which one has more or less of a given trait.
Interval	Classification + Order + Equal Units: This scale has all of the properties of the nominal and ordinal scales plus the characteristic of equal units which means that equal differences in scores represent equal differences in what is being measured.
Ratio	Classification + Order + Equal Units + and Absolute Zero: This is the highest level of measurement. Measurements of length, time, and weight are made upon this scale. Ratios become important here, i.e., a four-inch line is twice as long as a two-inch line, etc.

TABLE VI - UNIT III

IMPORTANT SYMBOLS

ΣX
x or d
Σx^2 or Σd^2
s^2 or σ^2
n
r
z
$\overline{X}$
$\overline{Y}$

TABLE VII - UNIT III

STEPS IN STATISTICAL INFERENCE

STEP	EXPLANATION
1. Define a **population**	This is the whole group in which a researcher is ultimately interested.
2. Draw a **sample** from the population	This is the group upon which the research is conducted.
3. Make **measurements** on the sample	Measurement may take many forms; tests, questionnaires, etc. This is the actual research.
4. Compute one or more **descriptive statistics**	Mean, mode, median, correlation, etc.
5. Use the descriptive statistics to make **inferences** or predictions about the population	Such simple inferential techniques as t-tests and simple analysis of variance may be employed, as well as more complex techniques.

III. Exercise #3a

A. [Data]

Student	Scores on Psychology Test	Deviation	Deviation Squared
	X	x or d	x^2 or d^2
A	18		
B	17		
C	20		
D	18		
E	16		
F	13		
G	13		
H	12		
I	11		
J	11		
K	10		
L	10		
M	10		
N	9		
O	7		
SUM			

B. [Procedure] - use plain sheet of paper

1. Add all the scores. This sum is called [ΣX]. $X =$ _____

2. Divide this sum by the number of scores [N]. This is the mean, X. $X = \frac{\Sigma X}{N} =$ _____

3. Subtract the mean from each score to find each deviation, [x] or [d] (Column headed "deviation").

4. Square each deviation, (Multiply each deviation by itself). $x^2 = (x-\bar{x})^2$ (See column headed "Deviation Squared).

5. Add all the squared deviations. This result will be called [Σx^2] or [Σd^2] $\Sigma x^2 =$ _____

6. Divide this sum by the number of scores to find the variance, [s^2] or [σ^2] $s^2 = \frac{\Sigma x^2}{N} =$ _____

7. Find the Square root of the variance. This will be designated by the standard deviation S or σ

$$S = \sqrt{\frac{\Sigma x^2}{N}} = _____$$

You should have now computed the following statistics:

Mean, standard deviation, variance.

Submit your work to the laboratory assistant.

IV. Exercise #3b

A. A standard score is the number of standard deviations above or below the mean where a given score falls.

B. It is given the symbol Z. Operationally, it is the deviation of a score from the mean $(x-\bar{x})$, divided by the standard deviation:

$$Z = \frac{(x-\bar{x})}{S}$$

C. Procedure

1. Find the standard scores for students A through H. From the data presented in Exercise 3a.

You have now computed standard scores. Submit your work to the laboratory assistant.

V. Exercise #4a

A. Data

Student	Arithmetic Comprehension		Arithmetic Computation		
	X	Zx	Y	Zy	ZxZy
A	20		48		
B	18		45		
C	18		45		
D	17		57		
E	16		39		
F	13		42		
G	13		52		
H	12		43		
I	11		47		
J	11		44		
K	10		41		
L	10		37		
M	10		43		
N	9		40		
O	7		37		
					ΣZxZy

B. Procedure

1. Compute the means and standard deviations for the variables X and Y.

   $\bar{X}$ = _____ Sx = _____

   $\bar{Y}$ = _____ Sy = _____

2. Convert each score to a standard score by subtracting its mean and dividing by its standard deviation. (See columns headed Zx and Zy).

3. Multiply the two standard scores together for each individual in the group. (See the column headed ZxZy).

4. Compute the mean of these products by adding them together and dividing by the number of individuals.

$$r = \frac{\Sigma ZxZy}{N} = \underline{\qquad\qquad}$$

You have now computed a product-moment coefficient correlation.

Please submit your work to your laboratory assistant.

VI. Exercise #4b

A. Procedure: Use the following data to Construct:

1. A frequency Distribution
2. A frequency Histogram
3. A frequency Polygon

B. Data

3; 6; 1; 7; 2; 2; 8; 1; 3; 2; 6; 0; 2; 8; 5;

1; 7; 6; 8; 2; 1; 7; 3; 2; 6; 4; 0; 5; 3; 4;

6; 1; 9; 7; 2; 6; 4; 9; 8; 4; 5; 2; 9; 3; 6;

9; 3; 5; 7; 3; 6; 5; 5; 7; 8; 4; 6; 3; 7; 4;

3; 4; 2; 5;10; 4; 5; 4; 7; 5; 8; 3; 3; 5; 5;

8; 5; 5; 2; 5; 7; 4; 5; 7; 5; 6; 4; 5; 5; 8;

1; 4; 8; 5; 9; 6; 3; 5;10; 4.

Please submit your work to the laboratory assistant.

S T O P

1. You should now be prepared to take preliminary examination #1. You will have one and one-half hours to complete the examination.

2. If you have any questions concerning what you should know at this point, please consult the objectives stated at the beginning of the preceeding units.

3. You may take the examination when you feel that you are ready. Simply indicate to your laboratory assistant that you wish to take preliminary examination #1.

APPENDIX D

REPRESENTATIVE MATERIALS FROM WORKSHEETS FOR A DEVELOPMENTAL ENGLISH SYSTEM, JOSEPH F. DUNNE

A unit showing the relationship between goals, rationale, and objectives.

UNIT 1

GOAL: The student should develop the habit of writing frequently.

RATIONALE: Considering how long people have been writing, we know surprisingly little about what goes on in the writer's head as he moves from the conception of an idea or the assignment of a task to the completion of the final copy. Every English teacher, of course, has his own pet theory, but most of these theories have little research to support them.

We do know, however, that the more at ease a writer finds himself as he sits before a blank sheet, the easier it will be for him to write. Since the act of writing is a mechanical function, just getting the right muscules moving should be of some help. Also, practice in writing just what you want to write can reduce some of the tension that students too frequently experience when they write in English courses.

But most important, practice in refining an idea and supporting it will make writing a little more natural the next time around. Certainly writing isn't easy, and good writing -- clear, concise, and vivid writing -- is the result of more sweat than ink. Yet how much more difficult is it to write if writing is only a sometime experience done under duress? Loosen up, enjoy writing as you should enjoy anything you do.

DISCUSSION: This goal will be met in two ways. First, the student will regularly write assignments of varying length which will be evaluated and contribute toward awarding the final grade. These assignments, at least one a week, may be done in class as well as outside of class. The directions for each assignment are given as behavioral objectives throughout the guidebook. Second, the student will keep a journal in which he consistently writes about his experiences and views.

(Incidentally, no papers will be returned at the end of the semester. If you want to keep your essays, make a carbon copy of each when you write or type it.)

OBJECTIVE: 1.1 Beginning the second week of the semester, the student should write at least five entries a week in a journal kept in a standard spiral notebook. The journal entries, which should be dated, may be on any subject which interests the student. They should be at least fifteen minutes long. The journal will not be graded, but it will be reviewed with comments made on the successful aspects of the student's style as well as suggestions for improvement. The student will be expected to share his journal with the instructor at least once a month. Satisfactory completion of this objective is a prerequisite for a passing grade in this course.

Some Directions and Observations:

1) Purchase an 8½ x 11 spiral notebook.

2) Put the following on the cover: your name, your address, your phone number, "Journal for 40.001-03, Meramec Community College." With all of this information the journal should be returned to you if lost.

3) Open the book to the first page or to the end of your last entry. At the top of page or a few spaces below the last entry write the day's date.

4) Proceed to write the entry. It can be any length, though you should spend at least fifteen minutes writing. An entry can be on any subject which interests you. Here are some possible ideas:

   Your views on an event of the day, whether a personal experience or a story in the news.

   A summary of or comments upon a lecture, magazine article, film, or discussion which interested you that day.

   Some preliminary ideas for a paper that you would like to write.

   A description of a simple object to sharpen your ability to use language to create a picture.

   An attempt to imitate the style or structure of an essay being discussed in class.

Try to avoid turning the journal into a diary. A simple recounting of the day's events usually lacks the unity which you should strive to include in journal entries.

If the experience of writing a journal is to be meaningful, you will have to write regularly -- daily writing would be the best practice. If you don't write until the end of the week or until you have to hand in the journal, it will be more of a bother than a learning experience.

At first you may find yourself lost, unable to focus on a subject. Whenever this happens, just write the first thing that comes into your mind and keep writing what comes to mind. The resulting piece of writing may seem silly, but eventually the practice will loosen you up. As you go along during the semester try to vary your choice of subjects and the approach which you take to them. Also, begin to apply the concepts about writing which we will be discussing in class.

By the end of the semester I hope you can look back through your journal and see reflected in it the development of a personality. You should be able to see growth in your understanding and control of the language. You should see a writer coming to a better understanding of himself. And you should see a young adult reacting to and growing through the experience of college. That is a very exciting prospect; I hope you will take advantage of it.

Worksheets showing relationship between an objective and its supporting materials.

Often a student uses a textbook for some time before he recognizes all of the aids and extra features which the text provides. For example, he may not recognize how the organization of a chapter may help in studying or that the book contains some useful tables or summaries of formulae in an appendix. Ten minutes spent looking through a book when it is first used can save a great deal of time later.

OBJECTIVE: 2.2 The student will write, outside of class a report in which he previews a textbook used in a course other than English. The report will tell what he has discovered as a result of following the five steps used to preview a book. He will avoid any gross errors in organization and follow manuscript form.

(Do not write on the Rees and Sparks College Algebra. Also note the comments on conventions which is found on page 001.2.7.)

Previewing a book:

A preliminary step would be to check the _____ of the author or authors. As freshman you have to accept on faith that your instructor has already checked this. As you get to know the text there are five steps which you should follow:

1. _____

2. _____

3. _____

4. _____

5. _____

The papers below were written to fulfill OBJECTIVE 2.2. They each have their merits as well as their shortcomings. Reviewing them can help you to write a better paper.

College Algebra, fifth edition, written by Paul K. Rees and Fred W. Sparks is the text used in Intermediate Algebra. The floormat of the 1967 copyright covers from the number system to partial fractions in twenty-two chapters.

Each chapter is broken down into sub-headings that are numbered for easy reference. The important points of the sub-headings are pointed out by arrowheads with examples or proofs added to better explain what was stated. Exercise problems are grouped throughout the chapters.

The Preface explains that this edition is mainly a revision of the previous one with the section on sets added and some chapters rearranged.

The index seems quite complete and should be very helpful.

Extra features includes an appendix on axioms, therom, and formulas and another on reference materials from trigonemetry. Also there are four tables covering logarithems, trig functions, powers and roots and American experience table of mortality. Another feature is the answer to most of the problems.

This recent text should be easy to use and understand as well as very informative.

Is the organization of this essay (the order in which the parts of the book are described) natural? Can you suggest a more natural order?

Does the writer give enough specific detail to show that the book should be "easy to use and understand as well as very informative."

In the first paragraph this writer uses a word that sounds similar to the word he actually wanted to use. Where did he do this? What word did he really mean?

College Algebra
by
Rees and Sparks

While I was investigating my College Algebra text, I discovered that it presented the material in a modern and logical fashion. Noting the copyright was in 1961, 1967, I was immediately assured that its methods and applications could be applied in today's mathematics and sciences.

After reading the preface and studying the arrangement of the contents, I ascertained that the author commenced with the elementary and fundamental aspects of algebra, and he gradually progressed to the more involved and perplexing aspects of algebra. His systematic progression is reflected in each chapter. The author, first, acquaints and explains the material, second, he gives problems and their solutions relating to the material; and finally, he has reserved a section with exercises for the students to calculate.

Numberous aids are available to the student when he is working the problems. The appendix contains many useful aids: such as trigonometric functions, a table of logarithem, powers and roots, and a table of morality. In addition to these instruments, the author has given the answers to various problems of each chapter for the students to compare with their answers. The index provided can be beneficial to students when they desire to quickly review some facet of algebra.

In my opinion the author has written an effective text which will be profitable to me throughout the course.

How natural is the organization of this paper?

Do you know any college freshmen who talk the way this person writes in paragraph 2? How would you change the diction (word choice) of this paragraph?

In paragraph 3 we have another homonym problem (words that sound similar but have different spellings and meanings). Where is the problem? What word dod he mean to use?

Some Conventions to Follow When Writing About Books:

a) Titles of books are underlined.
b) Titles of chapters or essays within a book are put in quotation marks.
c) Names of the parts of books (Preface, Table of Contents, Index, etc.) are capitalized and neither underlined nor set in quotation marks.

Example: Today we were to read "A Note to the Student" in Pl in English Please and the Preface to Models for Composition 2.

An active involvement sheet used in class. Students complete the sheets by following the lecture and add extra comments based upon class discussion or their personal interests.

THE SUMMARY AND THE REVIEW

Aids: "Something About Summary," Plain English Please, p. 273ff.
"Compressing Ideas," EDL Listen and Read, Lesson 13 (in the Learning Laboratory).

The ability to summarize, to recognize the main idea and supporting ideas of a selection, is a very important skill. Summary serves two purposes:

a. _____

b. _____

Vocabulary: It is important for you to know the difference between the following terms.

a. paraphrase _____

_____

_____

The goal of paraphrasing is to _____.

b. notes _____

_____

_____

c. summary _____

_____

_____

A summary should be _____; it should not contain facts or opinions which do not appear in the original selection.

d. review _____

_____

_____

The most important thing to remember when writing a review is to

_____

_____

_____

Writing a Summary:

(See PEP, p.276 for further help and more examples.)

Step 1: _____

Step 2: _____

a. _____

b. _____

c. _____

d. _____

You should tell who wrote the selection, its title, and where it can be found.

For help in doing this see PEH, section 59h, on documentation. Or follow this form:

for essays:

John Jones, "The Bug," in Essays for Understanding, ed. James Smith (1967), pp. 46-49.

for magazine articles:

John Smith, "Indian Maidens I Have Known," American History Journal (March 1965), pp. 143-147.

Step 3: _____

a. _____

b. _____